



NASA SILICON VALLEY LIVE

NASA SILICON VALLEY  
AMES RESEARCH CENTER

1  
00:00:00,030 --> 00:00:07,480  
six five four three two

2  
00:00:27,650 --> 00:00:24,850  
[Music]

3  
00:00:29,570 --> 00:00:27,660  
hey what's up everybody welcome to this

4  
00:00:32,089 --> 00:00:29,580  
episode of NASA and Silicon Valley live

5  
00:00:34,610 --> 00:00:32,099  
for September 13th 2018

6  
00:00:37,790 --> 00:00:34,620  
I'm your host ABI Tabor and I have with

7  
00:00:39,590 --> 00:00:37,800  
me a new face today my co-host hi I'm

8  
00:00:42,170 --> 00:00:39,600  
Christina Chung and if you didn't know

9  
00:00:44,330 --> 00:00:42,180  
this is a NASA of Silicon Valley live a

10  
00:00:45,979 --> 00:00:44,340  
conversational show out of NASA Ames

11  
00:00:47,870 --> 00:00:45,989  
Research Center with the various

12  
00:00:50,210 --> 00:00:47,880  
scientists researchers engineers and all

13  
00:00:52,640 --> 00:00:50,220

around very cool people at NASA where we

14

00:00:54,920 --> 00:00:52,650

talk about the nerdy news that you need

15

00:00:58,460 --> 00:00:54,930

to know about absolutely yeah and you

16

00:00:59,660 --> 00:00:58,470

can watch us live on twitch YouTube and

17

00:01:01,910 --> 00:00:59,670

Facebook but if you want to ask

18

00:01:03,470 --> 00:01:01,920

questions to our expert so I'm going to

19

00:01:05,780 --> 00:01:03,480

introduce in a minute you need to be on

20

00:01:08,300 --> 00:01:05,790

twitch so go to twitch.tv slash NASA

21

00:01:10,700 --> 00:01:08,310

watch us live but if you miss us you can

22

00:01:12,860 --> 00:01:10,710

watch us on demand later including on

23

00:01:14,480 --> 00:01:12,870

NASA TV and there's always the audio

24

00:01:18,320 --> 00:01:14,490

version if you want to hear the podcast

25

00:01:20,149 --> 00:01:18,330

version so let's go today we're gonna be

26  
00:01:23,330 --> 00:01:20,159  
talking to you about studying life in

27  
00:01:24,560 --> 00:01:23,340  
space as in what happens to earth life

28  
00:01:27,410 --> 00:01:24,570  
when we bring it into the weird

29  
00:01:29,630 --> 00:01:27,420  
conditions of space and later on in the

30  
00:01:31,639 --> 00:01:29,640  
show we're gonna share some genius space

31  
00:01:33,830 --> 00:01:31,649  
hacks that our researchers have come up

32  
00:01:35,510 --> 00:01:33,840  
with really simple solutions to do this

33  
00:01:38,330 --> 00:01:35,520  
incredible research that they're getting

34  
00:01:40,039 --> 00:01:38,340  
done so we're gonna get to that later

35  
00:01:42,950 --> 00:01:40,049  
but first let me introduce you to our

36  
00:01:45,580 --> 00:01:42,960  
guest today I have with me Sid son

37  
00:01:48,289 --> 00:01:45,590  
welcome Sid is the manager of the space

38  
00:01:52,520 --> 00:01:48,299

Biosciences division here at NASA Ames

39  
00:01:55,099 --> 00:01:52,530  
and I have Sharmila Bhattacharya Hey she

40  
00:01:59,929 --> 00:01:55,109  
is a senior scientist here studying a

41  
00:02:02,090 --> 00:01:59,939  
life in space welcome guys now I'm going

42  
00:02:04,609 --> 00:02:02,100  
to be looking at the chat for questions

43  
00:02:06,770 --> 00:02:04,619  
from the audience so while I'm browsing

44  
00:02:08,510 --> 00:02:06,780  
there meanwhile Christina you want to

45  
00:02:11,780 --> 00:02:08,520  
get us into the science today and sure

46  
00:02:13,730 --> 00:02:11,790  
definitely all righty so welcome Sid and

47  
00:02:16,930 --> 00:02:13,740  
Sharmila thank you for coming here and

48  
00:02:19,310 --> 00:02:16,940  
just to get the get all of us situated

49  
00:02:21,230 --> 00:02:19,320  
what is space Biosciences and why is

50  
00:02:23,600 --> 00:02:21,240  
this important that NASA does space

51  
00:02:25,190 --> 00:02:23,610  
Biosciences research yeah so we are

52  
00:02:28,700 --> 00:02:25,200  
studying life in space we're looking at

53  
00:02:32,920 --> 00:02:28,710  
all different types of organisms ranging

54  
00:02:37,199 --> 00:02:32,930  
from tiny little microbes tissue cells

55  
00:02:38,850 --> 00:02:37,209  
fruit flies other types of animals

56  
00:02:42,270 --> 00:02:38,860  
and the reason we're looking at all

57  
00:02:44,759 --> 00:02:42,280  
these is that we want to understand the

58  
00:02:47,580 --> 00:02:44,769  
risks that are facing our astronauts as

59  
00:02:49,020 --> 00:02:47,590  
we go onto Mars Mars itself is going to

60  
00:02:51,350 --> 00:02:49,030  
be roughly a two or three year

61  
00:02:53,339 --> 00:02:51,360  
round-trip mission for astronauts

62  
00:02:55,050 --> 00:02:53,349  
there's going to be a lot of risks that

63  
00:02:56,520 --> 00:02:55,060

they're going to be facing there's a

64

00:02:58,830 --> 00:02:56,530

high radiation environment that they're

65

00:03:00,809 --> 00:02:58,840

going to be exposed to they're going to

66

00:03:02,940 --> 00:03:00,819

be experiencing zero-gravity as they're

67

00:03:05,580 --> 00:03:02,950

getting to Mars when they get on to Mars

68

00:03:07,979 --> 00:03:05,590

they'll be dealing with roughly a 1/3

69

00:03:10,289 --> 00:03:07,989

gravity environment rough relative to

70

00:03:11,729 --> 00:03:10,299

what we experienced here on earth and

71

00:03:14,610 --> 00:03:11,739

then of course then they have the long

72

00:03:16,349 --> 00:03:14,620

trip back so there's a lot of changes

73

00:03:18,030 --> 00:03:16,359

they're going to be experiencing and

74

00:03:19,710 --> 00:03:18,040

there's a lot of things that it's going

75

00:03:22,009 --> 00:03:19,720

to be hard to study on the astronauts

76

00:03:25,110 --> 00:03:22,019

themselves so we do our studies with

77

00:03:27,750 --> 00:03:25,120

mice fruit flies and other organisms oh

78

00:03:29,759 --> 00:03:27,760

very cool sure Mila do you want to maybe

79

00:03:32,160 --> 00:03:29,769

expand on that yeah so I was going to

80

00:03:35,580 --> 00:03:32,170

say that you know if some of this says

81

00:03:38,160 --> 00:03:35,590

as we just talked about earlier that you

82

00:03:40,140 --> 00:03:38,170

want to know what happens in the humans

83

00:03:42,509 --> 00:03:40,150

or in astronauts but it's very hard to

84

00:03:45,780 --> 00:03:42,519

do these experiments on humans and so

85

00:03:48,119 --> 00:03:45,790

you need these little surrogates so to

86

00:03:49,860 --> 00:03:48,129

speak you know these tiny organisms so

87

00:03:51,479 --> 00:03:49,870

you actually understand the basic

88

00:03:54,300 --> 00:03:51,489

biological changes that are happening

89

00:03:56,550 --> 00:03:54,310

inside the cell so that you can then

90

00:03:58,979 --> 00:03:56,560

send you know with your crew that's

91

00:04:00,960 --> 00:03:58,989

going out there into Mars or moon

92

00:04:02,939 --> 00:04:00,970

explorations you can send them with you

93

00:04:05,069 --> 00:04:02,949

know the medications they need some of

94

00:04:06,899 --> 00:04:05,079

the countermeasures and to know what to

95

00:04:08,580 --> 00:04:06,909

send and and how to keep them healthy

96

00:04:11,789 --> 00:04:08,590

out there you need to understand the

97

00:04:13,800 --> 00:04:11,799

basic biology underlying these changes

98

00:04:16,020 --> 00:04:13,810

and that's what space Biosciences is

99

00:04:17,759 --> 00:04:16,030

about yeah amazing I already have a

100

00:04:18,839 --> 00:04:17,769

question you can tell me if you think

101  
00:04:21,569 --> 00:04:18,849  
we're gonna answer this throughout the

102  
00:04:23,279 --> 00:04:21,579  
show but Rev lucky shot wants to know

103  
00:04:25,860 --> 00:04:23,289  
what's the biggest difficulty in

104  
00:04:29,670 --> 00:04:25,870  
performing these tests in space very

105  
00:04:32,100 --> 00:04:29,680  
good question so I for me I think the

106  
00:04:36,180 --> 00:04:32,110  
biggest issue is the fact that you're

107  
00:04:39,240 --> 00:04:36,190  
limited in mass and volume so the size

108  
00:04:42,029 --> 00:04:39,250  
of your experiment has to be and you

109  
00:04:44,339 --> 00:04:42,039  
don't need you can't expect very much

110  
00:04:45,930 --> 00:04:44,349  
help from the crew because they're busy

111  
00:04:48,450 --> 00:04:45,940  
doing other more important things

112  
00:04:51,150 --> 00:04:48,460  
yes and so you have to have it often be

113  
00:04:53,040 --> 00:04:51,160

automated it has to be small and yet

114

00:04:55,410 --> 00:04:53,050

you're gonna have to ask those important

115

00:04:56,760 --> 00:04:55,420

science questions and you want to make

116

00:04:59,610 --> 00:04:56,770

sure that when the experiment comes back

117

00:05:01,670 --> 00:04:59,620

you can answer them so so designing that

118

00:05:04,350 --> 00:05:01,680

experiment so that it's successful

119

00:05:06,270 --> 00:05:04,360

useful but also fits within the

120

00:05:09,120 --> 00:05:06,280

constraints of the spaceflight or the

121

00:05:11,250 --> 00:05:09,130

challenge I think oh well speaking of

122

00:05:13,440 --> 00:05:11,260

things that we need to send into space I

123

00:05:16,950 --> 00:05:13,450

think we're gonna move on to a let's

124

00:05:18,930 --> 00:05:16,960

play our first segment yeah our first

125

00:05:22,770 --> 00:05:18,940

segment let's play and we will be

126  
00:05:25,530 --> 00:05:22,780  
answering the question has it been to

127  
00:05:28,580 --> 00:05:25,540  
space yeah want to roll that second

128  
00:05:33,779 --> 00:05:28,590  
build get us ready

129  
00:05:38,049 --> 00:05:33,789  
[Music]

130  
00:05:40,329 --> 00:05:38,059  
alright guys this is a game I have some

131  
00:05:42,819 --> 00:05:40,339  
questions for you and you guys watching

132  
00:05:44,739 --> 00:05:42,829  
can play along at home and if you get

133  
00:05:55,029 --> 00:05:44,749  
let's say 10 out of 10 of my questions

134  
00:05:57,819 --> 00:05:55,039  
we'll give you a shout out so so the

135  
00:06:02,979 --> 00:05:57,829  
question is has it been to space and I

136  
00:06:15,999 --> 00:06:02,989  
have for you 10 organisms alright the

137  
00:06:18,939 --> 00:06:16,009  
bear all right what about the jellyfish

138  
00:06:20,859 --> 00:06:18,949

jellyfish yes we have flown jellyfish

139

00:06:23,100 --> 00:06:20,869

really yeah why would you fly jelly

140

00:06:25,719 --> 00:06:23,110

basically y-yeah well

141

00:06:28,149 --> 00:06:25,729

jellyfish have these tiny little organs

142

00:06:30,729 --> 00:06:28,159

that help them sense the gravity feel

143

00:06:32,169 --> 00:06:30,739

that they're within and so we wanted to

144

00:06:34,569 --> 00:06:32,179

understand what happens when they're in

145

00:06:36,339 --> 00:06:34,579

an environment without gravity yeah

146

00:06:38,409 --> 00:06:36,349

that's cool to me that an ocean creature

147

00:06:44,889 --> 00:06:38,419

has that kind of dangerous they said I

148

00:06:46,089 --> 00:06:44,899

mean I'm scared of a jellyfish sting but

149

00:06:48,699 --> 00:06:46,099

that's where it's nice that it's all

150

00:06:56,019 --> 00:06:48,709

contained that's your true very true in

151  
00:06:58,269 --> 00:06:56,029  
their tanks all right ready rodents one

152  
00:07:02,259 --> 00:06:58,279  
of the organisms we fly the most oh yeah

153  
00:07:10,709 --> 00:07:02,269  
do our experiments with huh alright

154  
00:07:17,290 --> 00:07:15,279  
it's a squid yes we have done

155  
00:07:19,619 --> 00:07:17,300  
experiments which foods so another ocean

156  
00:07:25,389 --> 00:07:19,629  
critter we've actually said yes yes

157  
00:07:27,879 --> 00:07:25,399  
though no not giant squid little squid

158  
00:07:30,519 --> 00:07:27,889  
do you know why well it's an interesting

159  
00:07:33,369 --> 00:07:30,529  
experiment because these tiny squids

160  
00:07:35,529 --> 00:07:33,379  
they were growing from their baby stage

161  
00:07:37,490 --> 00:07:35,539  
essentially they were going through some

162  
00:07:39,980 --> 00:07:37,500  
changes in their body

163  
00:07:42,050 --> 00:07:39,990

we wanted to understand those changes

164

00:07:44,090 --> 00:07:42,060

would be different in the environment

165

00:07:45,980 --> 00:07:44,100

that they're experiencing in space yeah

166

00:07:48,230 --> 00:07:45,990

growing and developing and yeah how

167

00:07:55,750 --> 00:07:48,240

space change is that yeah cool what

168

00:08:00,970 --> 00:07:55,760

about our nation's favorite bird I

169

00:08:03,580 --> 00:08:00,980

didn't get a chance to go seems unfair

170

00:08:22,640 --> 00:08:03,590

those flying creatures know what about

171

00:08:24,650 --> 00:08:22,650

yes indeed one of my favorites have gone

172

00:08:27,170 --> 00:08:24,660

to space I've gone to space for science

173

00:08:29,090 --> 00:08:27,180

I you know that I think we were talking

174

00:08:32,540 --> 00:08:29,100

about it but what was so cool is that

175

00:08:35,209 --> 00:08:32,550

the spider made a web and it wasn't

176

00:08:36,770 --> 00:08:35,219

quite right they took it down those

177

00:08:38,180 --> 00:08:36,780

another one and it was perfect the

178

00:08:40,700 --> 00:08:38,190

second time so you're saying the spider

179

00:08:42,529 --> 00:08:40,710

learned yeah that's yeah that Fassett

180

00:08:44,300 --> 00:08:42,539

dude once it was messed up yeah it

181

00:08:47,150 --> 00:08:44,310

builds and you knew that was messed up

182

00:08:49,310 --> 00:08:47,160

to them down man knew how to adjust and

183

00:08:52,400 --> 00:08:49,320

make it right the second time all right

184

00:08:54,800 --> 00:08:52,410

that's very cool there's a question yeah

185

00:08:57,530 --> 00:08:54,810

so many ocean creatures have gone to

186

00:09:00,770 --> 00:08:57,540

space why so many is there a specific

187

00:09:02,870 --> 00:09:00,780

reason you choose marine animals um

188

00:09:04,520 --> 00:09:02,880

there are different type of organisms

189

00:09:06,410 --> 00:09:04,530

model organism that we there's a wide

190

00:09:17,510 --> 00:09:06,420

range of them and just I think just from

191

00:09:18,590 --> 00:09:17,520

your quiz there a couple people are

192

00:09:20,180 --> 00:09:18,600

asking about the birds

193

00:09:23,180 --> 00:09:20,190

okay there's been no eagle but have

194

00:09:25,700 --> 00:09:23,190

there been other birds and they want to

195

00:09:27,620 --> 00:09:25,710

know how would they yeah so we form

196

00:09:30,380 --> 00:09:27,630

different eggs in space and seeing how

197

00:09:31,850 --> 00:09:30,390

they have developed I believe there's

198

00:09:33,260 --> 00:09:31,860

been some birds from but I'm not too

199

00:09:35,000 --> 00:09:33,270

familiar with the science themselves

200

00:09:36,579 --> 00:09:35,010

well so so with that yeah and they've

201

00:09:40,280 --> 00:09:36,589

been flying things like they've been

202

00:09:42,650 --> 00:09:40,290

bumblebees and insects that why can they

203

00:09:44,600 --> 00:09:42,660

do the class and they succeed they do

204

00:09:46,750 --> 00:09:44,610

the bumblebee from what I remember there

205

00:09:50,670 --> 00:09:46,760

was a lot of tumbling so hobby

206

00:09:53,430 --> 00:09:50,680

I clearly knew that that gravity was

207

00:10:06,540 --> 00:09:53,440

yeah I figured it out eventually

208

00:10:15,790 --> 00:10:06,550

here's another ocean creature what about

209

00:10:17,230 --> 00:10:15,800

this guy what is this guy we've done

210

00:10:19,810 --> 00:10:17,240

some interesting experiment nudes

211

00:10:21,610 --> 00:10:19,820

because we want to see how what happens

212

00:10:24,280 --> 00:10:21,620

with the tail as it grows in space

213

00:10:27,490 --> 00:10:24,290

because there's a lot of tissue

214

00:10:28,750 --> 00:10:27,500

generation processes so with it and one

215

00:10:32,140 --> 00:10:28,760

of the interesting things we found out

216

00:10:35,680 --> 00:10:32,150

was newts grown on earth their tails

217

00:10:38,320 --> 00:10:35,690

have a downward bend to them but this

218

00:10:39,910 --> 00:10:38,330

the newts growing in space because

219

00:10:41,260 --> 00:10:39,920

there's no gravity the tails are

220

00:10:43,540 --> 00:10:41,270

perfectly symmetric and grow up

221

00:10:44,950 --> 00:10:43,550

horizontally relative to the animal and

222

00:10:47,020 --> 00:10:44,960

would you study something like that to

223

00:10:49,650 --> 00:10:47,030

understand how the human body could

224

00:10:53,080 --> 00:10:49,660

generate tissue yeah is that the

225

00:10:56,020 --> 00:10:53,090

connection yeah yeah so there there are

226

00:10:58,630 --> 00:10:56,030

these so the way the cells actually

227

00:11:01,780 --> 00:10:58,640

divide are very similar between all

228

00:11:03,790 --> 00:11:01,790

different organisms and so newts and you

229

00:11:06,550 --> 00:11:03,800

know with stem cells and so on there's a

230

00:11:09,190 --> 00:11:06,560

lot of applicability - yeah a lot of

231

00:11:25,650 --> 00:11:09,200

similarities ok I have one more all

232

00:11:30,490 --> 00:11:28,300

certain complexities descending in our

233

00:11:32,260 --> 00:11:30,500

wall space we did do a Twitter poll on

234

00:11:34,120 --> 00:11:32,270

this subject over the last couple of

235

00:11:35,410 --> 00:11:34,130

days and it seems that our followers

236

00:11:38,650 --> 00:11:35,420

nailed it

237

00:11:41,980 --> 00:11:38,660

the narwhal has not been to space yeah

238

00:11:44,590 --> 00:11:41,990

you guys were right so well done all

239

00:11:47,140 --> 00:11:44,600

right that's all I got for you so why

240

00:11:51,720 --> 00:11:47,150

the great diversity of organisms can you

241

00:11:54,760 --> 00:11:51,730

just kind of sum that up for us yeah so

242

00:11:57,460 --> 00:11:54,770

the different organisms have are studied

243

00:11:59,250 --> 00:11:57,470

in different ways you know one organism

244

00:12:01,620 --> 00:11:59,260

that I could talk to are

245

00:12:04,710 --> 00:12:01,630

the rodents that we fly in space a lot

246

00:12:06,690 --> 00:12:04,720

of the mice and rats that we have in

247

00:12:09,240 --> 00:12:06,700

space are used for different types of

248

00:12:13,410 --> 00:12:09,250

experiments number of them are involving

249

00:12:16,110 --> 00:12:13,420

bone and muscle research and so we've

250

00:12:18,030 --> 00:12:16,120

had experiments on space station where

251  
00:12:21,780 --> 00:12:18,040  
you want to examine what happens over

252  
00:12:25,740 --> 00:12:21,790  
course a time with the bone that are in

253  
00:12:29,820 --> 00:12:25,750  
the mice so what we have here is a model

254  
00:12:34,170 --> 00:12:29,830  
of a mouse femur or the hip bone and no

255  
00:12:36,270 --> 00:12:34,180  
this is not the actual size these kids

256  
00:12:38,340 --> 00:12:36,280  
when I show them this I tell them that

257  
00:12:43,560 --> 00:12:38,350  
we're trying to find giant mice on space

258  
00:12:45,510 --> 00:12:43,570  
station in their eyes no this is a 3d

259  
00:12:48,300 --> 00:12:45,520  
model the actual bone is much smaller

260  
00:12:52,650 --> 00:12:48,310  
it's more than just a fraction of an

261  
00:12:54,300 --> 00:12:52,660  
inch long but the bone loss is

262  
00:12:56,340 --> 00:12:54,310  
significant in space and the bone loss

263  
00:12:59,670 --> 00:12:56,350

we see in mice is much faster than what

264

00:13:01,680 --> 00:12:59,680

we see with humans so typically the bone

265

00:13:04,230 --> 00:13:01,690

loss and animal experiences within one

266

00:13:06,690 --> 00:13:04,240

month is equal to what an astronaut

267

00:13:11,250 --> 00:13:06,700

would experience across a whole year so

268

00:13:13,830 --> 00:13:11,260

we could see results much faster and you

269

00:13:15,330 --> 00:13:13,840

know not only are we at NASA interested

270

00:13:16,200 --> 00:13:15,340

in this phenomenon because we're curious

271

00:13:19,620 --> 00:13:16,210

about what's happening with the

272

00:13:21,870 --> 00:13:19,630

astronauts but it's also drug companies

273

00:13:24,720 --> 00:13:21,880

who are looking to deal with come up

274

00:13:26,940 --> 00:13:24,730

with treatments for osteoporosis very

275

00:13:30,390 --> 00:13:26,950

significant disease affecting many many

276

00:13:32,970 --> 00:13:30,400

people all right so we're working with

277

00:13:37,130 --> 00:13:32,980

companies like Novartis or antenori I

278

00:13:40,050 --> 00:13:37,140

Lilly develop develop new treatments and

279

00:13:45,120 --> 00:13:40,060

when one examples of what we're seeing

280

00:13:47,430 --> 00:13:45,130

is this is an example of what bone would

281

00:13:49,350 --> 00:13:47,440

normally look like ok and you can see

282

00:13:53,060 --> 00:13:49,360

this is the inside of the bone can you

283

00:13:54,960 --> 00:13:53,070

guys see that with the camera and

284

00:13:56,880 --> 00:13:54,970

normally the inside of the bone does

285

00:14:01,170 --> 00:13:56,890

have this cheese-like structure but

286

00:14:03,330 --> 00:14:01,180

there's a lot of blue structure

287

00:14:05,910 --> 00:14:03,340

it's just colored this way to illustrate

288

00:14:07,830 --> 00:14:05,920

it but the mouse bone I was saying in

289

00:14:10,530 --> 00:14:07,840

space after 30 days experience

290

00:14:13,230 --> 00:14:10,540

significant loss and this is what we see

291

00:14:16,680 --> 00:14:13,240

after 30 days so you'll see

292

00:14:18,930 --> 00:14:16,690

much larger holes in the middle yeah and

293

00:14:20,699 --> 00:14:18,940

so with the best structure more holes

294

00:14:23,460 --> 00:14:20,709

that's definitely telling us that the

295

00:14:24,630 --> 00:14:23,470

bones are far weaker okay and so we're

296

00:14:27,060 --> 00:14:24,640

worried about this you know what's gonna

297

00:14:28,769 --> 00:14:27,070

happen when the astronauts have to do

298

00:14:30,030 --> 00:14:28,779

work perhaps when they land on Mars and

299

00:14:31,380 --> 00:14:30,040

if they're gonna have weaker bones it's

300

00:14:33,449 --> 00:14:31,390

gonna be there with much more prone to

301  
00:14:34,860 --> 00:14:33,459  
injuries and right right and you need to

302  
00:14:36,660 --> 00:14:34,870  
figure that out now right before they

303  
00:14:38,730 --> 00:14:36,670  
arrive there's a question that might be

304  
00:14:40,320 --> 00:14:38,740  
related to this what's the most notable

305  
00:14:41,730 --> 00:14:40,330  
breakthrough in the medical field that

306  
00:14:44,250 --> 00:14:41,740  
has been found through space

307  
00:14:46,440 --> 00:14:44,260  
experimentation is that a good example

308  
00:14:47,670 --> 00:14:46,450  
yeah yeah exactly where we're working

309  
00:14:50,760 --> 00:14:47,680  
with companies all the time to

310  
00:14:53,220 --> 00:14:50,770  
understand how this is playing out so

311  
00:14:55,889 --> 00:14:53,230  
and then we're doing experiments in cell

312  
00:14:58,699 --> 00:14:55,899  
biology immunology sending how to

313  
00:15:00,780 --> 00:14:58,709

prevent people from getting infections

314

00:15:04,710 --> 00:15:00,790

so there's a wide range of different

315

00:15:06,199 --> 00:15:04,720

diseases that were examining do you want

316

00:15:08,340 --> 00:15:06,209

to talk more about some of the other

317

00:15:10,410 --> 00:15:08,350

experiments that Ames his sense of space

318

00:15:14,670 --> 00:15:10,420

and a rodent research is one of them

319

00:15:16,980 --> 00:15:14,680

right yeah definitely um so charmoula I

320

00:15:18,780 --> 00:15:16,990

know you are one of our resident fruit

321

00:15:20,430 --> 00:15:18,790

fly experts here is anything you can

322

00:15:21,750 --> 00:15:20,440

tell us a little bit about the fruit fly

323

00:15:24,329 --> 00:15:21,760

research is done at NASA Ames Research

324

00:15:28,680 --> 00:15:24,339

Center yeah certainly I'd love to so

325

00:15:30,630 --> 00:15:28,690

here you can see this vial here is you

326

00:15:32,670 --> 00:15:30,640

know contains these fruit flies you can

327

00:15:35,160 --> 00:15:32,680

see them you know you probably have seen

328

00:15:38,100 --> 00:15:35,170

them in the house buzzing around your

329

00:15:40,560 --> 00:15:38,110

rotting bananas and they're tiny but

330

00:15:43,199 --> 00:15:40,570

they're extremely useful and so fruit

331

00:15:45,329 --> 00:15:43,209

flies for example are used on earth to

332

00:15:47,910 --> 00:15:45,339

understand various disease conditions

333

00:15:50,190 --> 00:15:47,920

along with you know how does your immune

334

00:15:52,680 --> 00:15:50,200

system work so when you get infected by

335

00:15:54,510 --> 00:15:52,690

a microbe a bug you know and you you do

336

00:15:55,949 --> 00:15:54,520

feel better and the day or so you know

337

00:15:58,800 --> 00:15:55,959

how does that happen how does your body

338

00:16:00,600 --> 00:15:58,810

cope so the fruit fly actually has an

339

00:16:03,780 --> 00:16:00,610

innate immune system that's very similar

340

00:16:06,060 --> 00:16:03,790

to humans so we learn a lot about you

341

00:16:07,800 --> 00:16:06,070

know immune system the brain you know

342

00:16:10,170 --> 00:16:07,810

how does the brain respond in a new

343

00:16:12,329 --> 00:16:10,180

situation and you know being in space is

344

00:16:14,940 --> 00:16:12,339

definitely a new situation for most

345

00:16:16,949 --> 00:16:14,950

organisms you see every flies a brain it

346

00:16:18,900 --> 00:16:16,959

has a brain secretly are we talking like

347

00:16:23,960 --> 00:16:18,910

I mean it's got to be small microscopic

348

00:16:26,519 --> 00:16:23,970

yes what was surprisingly very

349

00:16:28,499 --> 00:16:26,529

structurally very similar you know in

350

00:16:30,569 --> 00:16:28,509

the way the neurons function and stuff

351

00:16:32,460 --> 00:16:30,579

Wow is actually very similar to that

352

00:16:34,919 --> 00:16:32,470

there are many fewer neurons that flare

353

00:16:36,779 --> 00:16:34,929

salad so it's simpler which also makes

354

00:16:38,909 --> 00:16:36,789

it easier to study because then you

355

00:16:40,799 --> 00:16:38,919

actually you know can can look at

356

00:16:43,409 --> 00:16:40,809

changes in the brain and changes in the

357

00:16:45,210 --> 00:16:43,419

behavior and new situations and start to

358

00:16:46,710 --> 00:16:45,220

draw correlations as to you know which

359

00:16:49,619 --> 00:16:46,720

genes are important which part of the

360

00:16:51,839 --> 00:16:49,629

brain is important so similarly you know

361

00:16:53,849 --> 00:16:51,849

the heart is another important you know

362

00:16:56,460 --> 00:16:53,859

organ system there's several of these

363

00:16:58,499 --> 00:16:56,470

you know the circadian system which

364

00:17:01,289 --> 00:16:58,509

means you know your night and day night

365

00:17:03,809 --> 00:17:01,299

and day so when you have jet lag or or

366

00:17:05,999 --> 00:17:03,819

you have to be there all night with an

367

00:17:08,189 --> 00:17:06,009

all-nighter you know your your sleep is

368

00:17:09,869 --> 00:17:08,199

thrown off and study that in flies and

369

00:17:13,259 --> 00:17:09,879

you can study that in places like the

370

00:17:15,779 --> 00:17:13,269

Nobel Prize actually recently what went

371

00:17:18,210 --> 00:17:15,789

to a Drosophila researcher who worked

372

00:17:20,549 --> 00:17:18,220

that all out and fertilized and it's

373

00:17:22,259 --> 00:17:20,559

very applicable those same genes or many

374

00:17:24,240 --> 00:17:22,269

of those genes and pathways are very

375

00:17:26,039 --> 00:17:24,250

applicable to humans and that's how we

376

00:17:28,079 --> 00:17:26,049

know a lot about what happens in

377

00:17:30,240 --> 00:17:28,089

mammalian systems along with studies and

378

00:17:32,039 --> 00:17:30,250

other you know those after that but but

379

00:17:35,039 --> 00:17:32,049

a lot of this work was started with the

380

00:17:39,060 --> 00:17:35,049

rag did you tell me that your students

381

00:17:41,100 --> 00:17:39,070

develop that hardware you know the other

382

00:17:43,080 --> 00:17:41,110

major advantage of doing something like

383

00:17:45,600 --> 00:17:43,090

fruit flies in addition to its

384

00:17:49,139 --> 00:17:45,610

similarity to the humans is that you can

385

00:17:51,749 --> 00:17:49,149

fit thousands of these flies into a one

386

00:17:55,320 --> 00:17:51,759

box this size which was developed in

387

00:17:57,360 --> 00:17:55,330

fact in my lab by summer students and

388

00:17:59,369 --> 00:17:57,370

and then NASA you know helped kind of

389

00:18:01,619 --> 00:17:59,379

ruggedized it and make it a bit more

390

00:18:04,019 --> 00:18:01,629

robust but otherwise essentially the

391

00:18:06,779 --> 00:18:04,029

design is that made by students and so

392

00:18:10,200 --> 00:18:06,789

we can bring back thousands of flies in

393

00:18:12,149 --> 00:18:10,210

a box this small and you can just you

394

00:18:13,980 --> 00:18:12,159

know you can really study and understand

395

00:18:17,190 --> 00:18:13,990

a lot of very valuable systems that you

396

00:18:19,619 --> 00:18:17,200

couldn't do in humans or in a larger

397

00:18:24,930 --> 00:18:19,629

organism like you said the ego where you

398

00:18:29,500 --> 00:18:27,520

speaking of you know hardware developed

399

00:18:32,290 --> 00:18:29,510

here at Ames I know there's also piece

400

00:18:34,360 --> 00:18:32,300

of hardware up here developed by Ames

401  
00:18:38,980 --> 00:18:34,370  
researchers as well is that right yeah

402  
00:18:41,260 --> 00:18:38,990  
so what we have here is the it's a

403  
00:18:44,470 --> 00:18:41,270  
cassette from the bio culture system and

404  
00:18:48,820 --> 00:18:44,480  
this is a system we developed at Ames to

405  
00:18:51,700 --> 00:18:48,830  
grow cells in space what we have down at

406  
00:18:53,320 --> 00:18:51,710  
the bottom in in pink and blue is the

407  
00:18:57,040 --> 00:18:53,330  
bioreactor and that's where the cells

408  
00:18:57,400 --> 00:18:57,050  
actually grow and to keep the cells

409  
00:19:00,430 --> 00:18:57,410  
alive

410  
00:19:03,400 --> 00:19:00,440  
we have fluids that are circulating and

411  
00:19:06,820 --> 00:19:03,410  
the fluids provide the nutrients the

412  
00:19:08,920 --> 00:19:06,830  
gases to supply the the cells and also

413  
00:19:14,620 --> 00:19:08,930

carrier way to waste products it looks

414

00:19:17,200 --> 00:19:14,630

like a really complex system we have ten

415

00:19:19,000 --> 00:19:17,210

cassettes ten copies of these that are

416

00:19:21,490 --> 00:19:19,010

in what's called the bio culture system

417

00:19:25,030 --> 00:19:21,500

so by having ten ADIZ were able to

418

00:19:27,910 --> 00:19:25,040

examine multiple samples or different

419

00:19:31,120 --> 00:19:27,920

samples of whatever whatever cells were

420

00:19:34,180 --> 00:19:31,130

wanting to grow so cool I'm gonna keep

421

00:19:35,440 --> 00:19:34,190

us moving because we're running short on

422

00:19:36,430 --> 00:19:35,450

time and we have so much more that we

423

00:19:38,380 --> 00:19:36,440

want to ask and I have a bunch of

424

00:19:39,340 --> 00:19:38,390

questions that I'm gonna save in just a

425

00:19:40,720 --> 00:19:39,350

minute

426

00:19:42,790 --> 00:19:40,730

this stuff is all things you've

427

00:19:46,750 --> 00:19:42,800

developed fairly recently and you're

428

00:19:48,970 --> 00:19:46,760

using now what's next is that do you

429

00:19:50,800 --> 00:19:48,980

want to talk about this it's right um so

430

00:19:52,060 --> 00:19:50,810

I really you're also the principal

431

00:19:54,850 --> 00:19:52,070

investigator for another very

432

00:19:57,100 --> 00:19:54,860

interesting experiment called be I was

433

00:19:58,420 --> 00:19:57,110

fentanyl wow that's such a cool name I

434

00:20:08,830 --> 00:19:58,430

mean anything with the word sensible in

435

00:20:11,890 --> 00:20:08,840

it I think it's cool oh yes and while

436

00:20:13,150 --> 00:20:11,900

while CID is helping bring the model

437

00:20:14,770 --> 00:20:13,160

over so you can see what the satellite

438

00:20:16,960 --> 00:20:14,780

looks like let me show you what the

439

00:20:20,110 --> 00:20:16,970

yeast cells look like so these are yeast

440

00:20:22,990 --> 00:20:20,120

cells not dissimilar at all to the yeast

441

00:20:26,440 --> 00:20:23,000

that you have that help make bread or

442

00:20:29,539 --> 00:20:26,450

beer those of you only above 21 would

443

00:20:31,909 --> 00:20:29,549

know what I mean by beer

444

00:20:35,240 --> 00:20:31,919

but so what you're seeing here for

445

00:20:37,220 --> 00:20:35,250

example each of these spots is actually

446

00:20:40,519 --> 00:20:37,230

hundreds and thousands of yeast cells

447

00:20:42,320 --> 00:20:40,529

each in fact one each of these colonies

448

00:20:44,659 --> 00:20:42,330

was founded by one single cells so

449

00:20:46,639 --> 00:20:44,669

remember how I talk to you about fruit

450

00:20:48,919 --> 00:20:46,649

flies and an advantage being numbers

451  
00:20:51,409 --> 00:20:48,929  
well similarly there I could fly

452  
00:20:54,289 --> 00:20:51,419  
thousands of flies in a box that big

453  
00:20:57,409 --> 00:20:54,299  
here I can I can fly millions and

454  
00:21:00,039 --> 00:20:57,419  
billions of cells in a satellite the

455  
00:21:02,659 --> 00:21:00,049  
size and wise number important because

456  
00:21:04,669 --> 00:21:02,669  
you know you need those numbers to do

457  
00:21:06,919 --> 00:21:04,679  
statistics in science so that when you

458  
00:21:08,990 --> 00:21:06,929  
see a change you know it's believable

459  
00:21:11,149 --> 00:21:09,000  
and reproducible so you need a large

460  
00:21:13,700 --> 00:21:11,159  
number right so what are we doing with

461  
00:21:17,019 --> 00:21:13,710  
these yeast in the satellite and why is

462  
00:21:20,019 --> 00:21:17,029  
it interesting well for one thing

463  
00:21:22,940 --> 00:21:20,029

remember Sid mentioned that when you go

464

00:21:25,190 --> 00:21:22,950

deep into space as more radiation right

465

00:21:27,649 --> 00:21:25,200

and so we want to understand what that

466

00:21:29,539 --> 00:21:27,659

radiation would do to biology what would

467

00:21:32,869 --> 00:21:29,549

happen to an astronaut who is going to

468

00:21:36,289 --> 00:21:32,879

Mars and coming back and so we use these

469

00:21:39,159 --> 00:21:36,299

yeast cells who actually or which the

470

00:21:42,710 --> 00:21:39,169

the yeast cells have DNA repair

471

00:21:45,409 --> 00:21:42,720

mechanisms very similar to humans so

472

00:21:47,810 --> 00:21:45,419

when the radiation actually damages DNA

473

00:21:50,389 --> 00:21:47,820

for example in the yeast cell and and

474

00:21:52,970 --> 00:21:50,399

then it's repaired we can actually learn

475

00:21:54,350 --> 00:21:52,980

a lot about that repair mechanism using

476

00:21:56,779 --> 00:21:54,360

these so that's not crazy how all of

477

00:22:00,049 --> 00:21:56,789

life uses the same thing simply from a

478

00:22:03,430 --> 00:22:00,059

little tiny cell disguise to the fly to

479

00:22:05,950 --> 00:22:03,440

the you know to the eagle to the where

480

00:22:08,570 --> 00:22:05,960

you know made up of very similar

481

00:22:10,399 --> 00:22:08,580

building blocks cells are gonna go in

482

00:22:12,019 --> 00:22:10,409

that satellite right it's going to go in

483

00:22:14,529 --> 00:22:12,029

this satellite and there used to sound

484

00:22:17,149 --> 00:22:14,539

like gonna go yeah that's right question

485

00:22:19,249 --> 00:22:17,159

question it's actually going to go very

486

00:22:21,919 --> 00:22:19,259

very far it's gonna go towards the Sun

487

00:22:23,749 --> 00:22:21,929

and it's going to in six months it'll be

488

00:22:27,110 --> 00:22:23,759

about a third of the weight of the Sun

489

00:22:32,969 --> 00:22:27,120

which is approximately thirty million

490

00:22:39,099 --> 00:22:36,369

very brave daring yes

491

00:22:41,469 --> 00:22:39,109

and we learn a lot from them about how

492

00:22:44,919 --> 00:22:41,479

the DNA will respond in this radiation

493

00:22:47,889 --> 00:22:44,929

environment how it will you know survive

494

00:22:50,619 --> 00:22:47,899

and so on and so we'll use it as a bio

495

00:22:53,109 --> 00:22:50,629

sensor to understand the effects of deep

496

00:22:55,749 --> 00:22:53,119

space and we'll have something called an

497

00:22:57,279 --> 00:22:55,759

let spectrometer which is also a dis

498

00:22:59,019 --> 00:22:57,289

scimitar which will also measure the

499

00:23:01,299 --> 00:22:59,029

radiation so that'll be the biological

500

00:23:04,029 --> 00:23:01,309

effect and an actual physical

501  
00:23:06,039 --> 00:23:04,039  
measurement which we will compare so why

502  
00:23:08,349 --> 00:23:06,049  
is there so much radiation you know

503  
00:23:10,930 --> 00:23:08,359  
outside of you know that far into space

504  
00:23:13,839 --> 00:23:10,940  
do you think you can kind of yeah and on

505  
00:23:18,249 --> 00:23:13,849  
that absolutely so so we on earth are

506  
00:23:19,959 --> 00:23:18,259  
lucky in a way and many many planets

507  
00:23:23,589 --> 00:23:19,969  
have this thing of where we have a

508  
00:23:30,539 --> 00:23:23,599  
magnetic field that protects us it's

509  
00:23:33,669 --> 00:23:30,549  
called the Van Allen belt and

510  
00:23:36,180 --> 00:23:33,679  
essentially this protective shell

511  
00:23:39,789 --> 00:23:36,190  
protects us from these highly energetic

512  
00:23:41,769 --> 00:23:39,799  
highly damaging particles that would

513  
00:23:45,669 --> 00:23:41,779

come at us either from the Sun or from

514

00:23:47,709 --> 00:23:45,679

the cosmic radiation and which could

515

00:23:50,109 --> 00:23:47,719

damage our DNA which could damage you

516

00:23:53,440 --> 00:23:50,119

know our cell membrane etc you know

517

00:23:55,659 --> 00:23:53,450

different parts of our body but we're

518

00:23:58,389 --> 00:23:55,669

protected on Earth's surface but then

519

00:24:01,599 --> 00:23:58,399

when you go to Mars or moon you're going

520

00:24:03,819 --> 00:24:01,609

beyond this protective sphere and that's

521

00:24:06,279 --> 00:24:03,829

why you know and before we send humans

522

00:24:09,459 --> 00:24:06,289

for very long duration missions you want

523

00:24:14,310 --> 00:24:09,469

to send these these sentinels o as

524

00:24:19,329 --> 00:24:17,019

would you say that all this bio sciences

525

00:24:20,739 --> 00:24:19,339

research is kind of ultimately leading

526

00:24:24,369 --> 00:24:20,749

up to sending humans farther into space

527

00:24:28,719 --> 00:24:24,379

is that the final goal for space by

528

00:24:31,180 --> 00:24:28,729

sciences that's definitely in Mars in

529

00:24:34,180 --> 00:24:31,190

the neuron that's right

530

00:24:36,339 --> 00:24:34,190

so we we've got to move on to our next

531

00:24:38,619 --> 00:24:36,349

segment and last with you guys we're

532

00:24:41,259 --> 00:24:38,629

gonna do a rapid-fire so it's okay

533

00:24:43,269 --> 00:24:41,269

vilkin through our animation up there

534

00:24:44,029 --> 00:24:43,279

we'll get started this is a segment

535

00:24:52,969 --> 00:24:44,039

where we

536

00:24:54,499 --> 00:24:52,979

ask you a whole bunch of questions I'm

537

00:24:55,940 --> 00:24:54,509

gonna fire a bunch of questions at you

538

00:24:58,159 --> 00:24:55,950

and you answer as many as you can in the

539

00:25:01,340 --> 00:24:58,169

next minute or so because then we have

540

00:25:04,960 --> 00:25:01,350

to move on to our next guests okay so

541

00:25:07,159 --> 00:25:04,970

there are a bunch from our viewers uh

542

00:25:08,989 --> 00:25:07,169

what is your favorite experiment that

543

00:25:14,450 --> 00:25:08,999

has been done in space question from

544

00:25:16,339 --> 00:25:14,460

Colin Ella and or well that's Colin's

545

00:25:18,049 --> 00:25:16,349

question my question was gonna be if you

546

00:25:21,440 --> 00:25:18,059

could do some Anu experiment what would

547

00:25:24,049 --> 00:25:21,450

it be okay these are all excellent I

548

00:25:27,619 --> 00:25:24,059

would say my favorite experiment in

549

00:25:30,289 --> 00:25:27,629

space was um when we fufu flies for the

550

00:25:32,299 --> 00:25:30,299

four we you know it hadn't been flown

551  
00:25:34,129 --> 00:25:32,309  
for a number of years and then we flew

552  
00:25:36,440 --> 00:25:34,139  
it to look at how the immune system

553  
00:25:38,450 --> 00:25:36,450  
changes and how it responds to an

554  
00:25:41,149 --> 00:25:38,460  
infection when they come back from space

555  
00:25:43,099 --> 00:25:41,159  
and these fruit flies you know the

556  
00:25:45,769 --> 00:25:43,109  
experiment was really successful came

557  
00:25:48,440 --> 00:25:45,779  
back we did the experiment and we found

558  
00:25:50,659 --> 00:25:48,450  
some really cool things about how the

559  
00:25:53,299 --> 00:25:50,669  
immune system was perturbed by

560  
00:25:56,450 --> 00:25:53,309  
spaceflight and found actually that they

561  
00:25:58,669 --> 00:25:56,460  
were perturbed in ways that were quite

562  
00:26:00,379 --> 00:25:58,679  
similar to the way they are affected in

563  
00:26:02,239 --> 00:26:00,389

humans and I thought that was very cool

564

00:26:04,249 --> 00:26:02,249

because we we learned quite a bit about

565

00:26:06,919 --> 00:26:04,259

the basics of what happens

566

00:26:09,379 --> 00:26:06,929

that's accruals here's another one from

567

00:26:12,680 --> 00:26:09,389

vanilla man 47 besides bone structure

568

00:26:14,599 --> 00:26:12,690

damage how to space affect our body yeah

569

00:26:17,779 --> 00:26:14,609

lots of different changes our

570

00:26:22,879 --> 00:26:17,789

cardiovascular changes immune system

571

00:26:25,369 --> 00:26:22,889

changes yeah that was interesting cuz

572

00:26:28,060 --> 00:26:25,379

that rose only when the astronauts were

573

00:26:31,219 --> 00:26:28,070

in space for three months and longer

574

00:26:33,469 --> 00:26:31,229

yeah and so those are the big the gross

575

00:26:36,080 --> 00:26:33,479

anatomical changes as we were just

576

00:26:38,570 --> 00:26:36,090

saying but then even at the deeper level

577

00:26:40,489 --> 00:26:38,580

at the cell level now you know people

578

00:26:42,440 --> 00:26:40,499

our scientists are beginning to do a lot

579

00:26:45,259 --> 00:26:42,450

more molecular biology and we're finding

580

00:26:47,690 --> 00:26:45,269

some pretty cool changes even at the sub

581

00:26:50,299 --> 00:26:47,700

cellular level so different organelles

582

00:26:55,339 --> 00:26:50,309

inside the cell and how they function

583

00:26:57,409 --> 00:26:55,349

and how your genes make proteins RNA and

584

00:26:59,029 --> 00:26:57,419

proteins those are all affected

585

00:27:02,029 --> 00:26:59,039

those are all changing those are all

586

00:27:05,149 --> 00:27:02,039

changing in tiny ways so then you know

587

00:27:07,519 --> 00:27:05,159

you can still survive and do your job

588

00:27:09,259 --> 00:27:07,529

but at the same time there are enough

589

00:27:11,839 --> 00:27:09,269

changes that you need to understand it

590

00:27:13,819 --> 00:27:11,849

so you know how to handle it for long

591

00:27:16,999 --> 00:27:13,829

duration by the time what it's like you

592

00:27:18,409 --> 00:27:17,009

send astronauts over blind exactly

593

00:27:20,509 --> 00:27:18,419

exactly

594

00:27:22,039 --> 00:27:20,519

Novus static wants to know do you expect

595

00:27:26,029 --> 00:27:22,049

experiments to be done in orbit around

596

00:27:27,979 --> 00:27:26,039

the moon yeah very much yeah yeah

597

00:27:31,999 --> 00:27:27,989

there's a NASA's envisioning something

598

00:27:35,060 --> 00:27:32,009

called gateway which could be a facility

599

00:27:37,279 --> 00:27:35,070

that will support experiments in space

600

00:27:38,979 --> 00:27:37,289

so we've been starting to define what

601  
00:27:42,819 --> 00:27:38,989  
kind of research like to do there

602  
00:27:45,499 --> 00:27:42,829  
exactly know lots of the for - yeah sure

603  
00:27:49,129 --> 00:27:45,509  
maybe one more quick one before we have

604  
00:27:50,719 --> 00:27:49,139  
to say goodbye do the astronauts have

605  
00:27:52,759 --> 00:27:50,729  
any involvement with any of these Space

606  
00:27:54,560 --> 00:27:52,769  
Station animal experiments or are they

607  
00:27:56,419 --> 00:27:54,570  
run autonomously from jerk

608  
00:27:58,279 --> 00:27:56,429  
oh no astronauts actually are big

609  
00:28:00,560 --> 00:27:58,289  
they're our partners in this you know

610  
00:28:04,069 --> 00:28:00,570  
for example the fruit fly mission that

611  
00:28:05,930 --> 00:28:04,079  
Christina and I ran recently we had to

612  
00:28:08,239 --> 00:28:05,940  
have astronauts actually give the flies

613  
00:28:10,549 --> 00:28:08,249

new food they took the samples they

614

00:28:11,959 --> 00:28:10,559

fixed it and preservative and froze them

615

00:28:14,389 --> 00:28:11,969

so that when they came back down we

616

00:28:16,039 --> 00:28:14,399

could analyze the molecular biology of

617

00:28:18,769 --> 00:28:16,049

the change yes they were like our hands

618

00:28:20,899 --> 00:28:18,779

yeah up there and we owe so much to them

619

00:28:23,719 --> 00:28:20,909

and all their hard work up there on the

620

00:28:25,699 --> 00:28:23,729

station and that's for the ISS but then

621

00:28:27,409 --> 00:28:25,709

when you do a satellite mission like we

622

00:28:31,909 --> 00:28:27,419

talked about by Sentinel then it's

623

00:28:33,739 --> 00:28:31,919

completely autonomous all by itself but

624

00:28:36,169 --> 00:28:33,749

it's just two different ways of doing

625

00:28:39,049 --> 00:28:36,179

science both very useful very useful

626

00:28:41,119 --> 00:28:39,059

yeah cool all right so I wish we could

627

00:28:43,339 --> 00:28:41,129

keep you for the whole hour we have more

628

00:28:47,899 --> 00:28:43,349

people to meet so thank you so much for

629

00:28:49,479 --> 00:28:47,909

coming on thank you for having and for

630

00:28:52,699 --> 00:28:49,489

those of you watching and quick reminder

631

00:28:56,509 --> 00:28:52,709

today we're talking about studying life

632

00:28:57,829 --> 00:28:56,519

in space and what kind of tools do we

633

00:29:01,459 --> 00:28:57,839

need to do that and what kind of

634

00:29:03,759 --> 00:29:01,469

questions can we answer if you have

635

00:29:05,870 --> 00:29:03,769

questions please leave them on twitch.tv

636

00:29:08,510 --> 00:29:05,880

slash NASA

637

00:29:09,920 --> 00:29:08,520

they are clearing out all the hardware

638

00:29:11,690 --> 00:29:09,930

that you got to see in the first half

639

00:29:13,910 --> 00:29:11,700

and we're bringing in a couple more

640

00:29:16,520 --> 00:29:13,920

researchers who are gonna talk to us

641

00:29:19,130 --> 00:29:16,530

about the space hacks genius hacks that

642

00:29:21,890 --> 00:29:19,140

they've developed in their labs to get

643

00:29:22,820 --> 00:29:21,900

research done either here on earth or up

644

00:29:25,790 --> 00:29:22,830

on the space station

645

00:29:28,100 --> 00:29:25,800

it doesn't always require some super

646

00:29:30,470 --> 00:29:28,110

specialized fancy equipment and they're

647

00:29:31,790 --> 00:29:30,480

gonna show us all about that coming up

648

00:29:37,700 --> 00:29:31,800

all right

649

00:29:41,210 --> 00:29:37,710

so hello hello welcome guys so now we've

650

00:29:42,110 --> 00:29:41,220

got a remit our crew here and actually I

651  
00:29:44,060 --> 00:29:42,120  
thought we should start with you

652  
00:29:45,590 --> 00:29:44,070  
Christina because you're our host for

653  
00:29:48,590 --> 00:29:45,600  
the day but you're also a scientist

654  
00:29:50,360 --> 00:29:48,600  
right so yes Abby yes I am the host for

655  
00:29:53,150 --> 00:29:50,370  
today but I also work with fruit flies

656  
00:29:56,690 --> 00:29:53,160  
in the lab a scientist yeah and then to

657  
00:29:58,850 --> 00:29:56,700  
my right we have hi I'm Cassie Juran I

658  
00:30:01,610 --> 00:29:58,860  
am a postdoctoral fellow and a

659  
00:30:03,590 --> 00:30:01,620  
bioengineer researcher am i interested

660  
00:30:07,300 --> 00:30:03,600  
in in stem cells in space and how

661  
00:30:09,980 --> 00:30:07,310  
regenerative mechanisms work very cool

662  
00:30:12,410 --> 00:30:09,990  
I'm Justine Richardson I'm a senior

663  
00:30:16,910 --> 00:30:12,420

research engineer so I actually built

664

00:30:20,270 --> 00:30:16,920

system to recycle air and water in space

665

00:30:22,850 --> 00:30:20,280

awesome Wow very cool and you know it's

666

00:30:24,290 --> 00:30:22,860

great to know you guys I'm just a little

667

00:30:26,930 --> 00:30:24,300

bit but we're actually gonna try to get

668

00:30:28,790 --> 00:30:26,940

to know a little better so we're gonna

669

00:30:31,040 --> 00:30:28,800

start another segment called weird

670

00:30:36,910 --> 00:30:31,050

science iord science

671

00:30:40,820 --> 00:30:36,920

[Music]

672

00:30:42,590 --> 00:30:40,830

all right so weird science um I wanted

673

00:30:45,470 --> 00:30:42,600

to ask you guys and also I will answer

674

00:30:47,390 --> 00:30:45,480

this myself yes what is the strangest

675

00:30:48,920 --> 00:30:47,400

thing you've done in the name of science

676  
00:30:51,730 --> 00:30:48,930  
and so while you guys think about it I

677  
00:30:53,420 --> 00:30:51,740  
will start off with mine and so my

678  
00:30:57,260 --> 00:30:53,430  
weirdest thing I've ever done with

679  
00:30:58,640 --> 00:30:57,270  
science is actually in college I ran a

680  
00:31:02,180 --> 00:30:58,650  
catering company with three other

681  
00:31:04,910 --> 00:31:02,190  
friends and we catered for weddings for

682  
00:31:08,630 --> 00:31:04,920  
school events for family parties and

683  
00:31:10,880 --> 00:31:08,640  
things like that but so we were able to

684  
00:31:13,670 --> 00:31:10,890  
cook for oh three hundred four hundred

685  
00:31:16,360 --> 00:31:13,680  
people at a time and that was a lot of

686  
00:31:19,460 --> 00:31:16,370  
fun but when I started working at NASA

687  
00:31:22,850 --> 00:31:19,470  
boy I did not think I would actually be

688  
00:31:27,290 --> 00:31:22,860

catering for flies so I actually make

689

00:31:29,000 --> 00:31:27,300

fly food every single week up to their

690

00:31:32,210 --> 00:31:29,010

specs of course I don't discriminate

691

00:31:34,430 --> 00:31:32,220

against clients and I make food for them

692

00:31:40,670 --> 00:31:34,440

so that they can survive and they can

693

00:31:43,580 --> 00:31:40,680

grow the food is made up of some grains

694

00:31:45,710 --> 00:31:43,590

there's also yeast a lot of sugar they

695

00:31:47,600 --> 00:31:45,720

love their sugar and then we also put a

696

00:31:50,990 --> 00:31:47,610

coagulating agent so it turns kind of

697

00:31:53,600 --> 00:31:51,000

like a jello almost fly jello fly

698

00:31:55,840 --> 00:31:53,610

Justina cheong fly jello caterer great

699

00:31:58,760 --> 00:31:55,850

on my resume

700

00:32:03,830 --> 00:31:58,770

excellent pretty weird yeah pretty weird

701  
00:32:05,660 --> 00:32:03,840  
little weird yeah I have any weird

702  
00:32:09,320 --> 00:32:05,670  
science like that but I have a weirdly

703  
00:32:11,870 --> 00:32:09,330  
dedicated to science kind of story when

704  
00:32:13,700 --> 00:32:11,880  
I was also in graduate school I was

705  
00:32:16,670 --> 00:32:13,710  
working on a personalized medicine

706  
00:32:19,460 --> 00:32:16,680  
project with with the guy who was

707  
00:32:23,390 --> 00:32:19,470  
sponsoring my my PhD and we were trying

708  
00:32:25,160 --> 00:32:23,400  
to replicate skeletal joints so that we

709  
00:32:26,900 --> 00:32:25,170  
could create an implant that was

710  
00:32:31,670 --> 00:32:26,910  
specialized for each individual patient

711  
00:32:35,000 --> 00:32:31,680  
Oh like custom-fit exactly so for this

712  
00:32:38,450 --> 00:32:35,010  
particular project we had done a three

713  
00:32:41,960 --> 00:32:38,460

dimensional x-ray or a x-ray computed

714

00:32:45,110 --> 00:32:41,970

commute I can't see speak today and as

715

00:32:48,660 --> 00:32:45,120

3d CT or computed tomography okay you

716

00:32:55,170 --> 00:32:50,850

and what I needed to do to complete the

717

00:32:56,340 --> 00:32:55,180

implant was to 3d print these skeletal

718

00:32:58,920 --> 00:32:56,350

structures so I could fit the implant

719

00:33:00,360 --> 00:32:58,930

perfectly and I needed a specific kind

720

00:33:03,299 --> 00:33:00,370

of printer and a specific kind of

721

00:33:04,620 --> 00:33:03,309

material and after a lot of searching I

722

00:33:07,260 --> 00:33:04,630

found a print shop that could do it

723

00:33:10,440 --> 00:33:07,270

and they told me to take about 16 hours

724

00:33:12,240 --> 00:33:10,450

to print and the guy who was normally

725

00:33:18,090 --> 00:33:12,250

the tech for printing was not going to

726

00:33:19,650 --> 00:33:18,100

be there until two days later so I

727

00:33:21,950 --> 00:33:19,660

literally said well I know how to use

728

00:33:24,540 --> 00:33:21,960

this printer can I stay here overnight

729

00:33:26,880 --> 00:33:24,550

the one who prints this over so I stayed

730

00:33:29,220 --> 00:33:26,890

for 16 hours and I made sure the Machine

731

00:33:30,480 --> 00:33:29,230

didn't break so that we had the printed

732

00:33:33,360 --> 00:33:30,490

model ready and we could fit the

733

00:33:36,890 --> 00:33:33,370

implants perfectly so I'm able to ask

734

00:33:39,330 --> 00:33:36,900

what did you print what's a little model

735

00:33:41,910 --> 00:33:39,340

for this specific project we were

736

00:33:43,110 --> 00:33:41,920

looking at the jaw or this specific

737

00:33:45,150 --> 00:33:43,120

section here it's called the

738

00:33:46,680 --> 00:33:45,160

temporomandibular joints when it goes

739

00:33:49,410 --> 00:33:46,690

bad it goes really bad really quickly

740

00:33:51,360 --> 00:33:49,420

and we were creating a tissue-engineered

741

00:33:54,180 --> 00:33:51,370

implant to basically correct that

742

00:33:56,549 --> 00:33:54,190

problem Wow and then was the patient

743

00:33:58,080 --> 00:33:56,559

alright so I wasn't the doctor but from

744

00:34:00,900 --> 00:33:58,090

everything I know it went really really

745

00:34:06,090 --> 00:34:00,910

well that's your exam occasion pay off

746

00:34:10,139 --> 00:34:06,100

your sleep I wrote excellent weird

747

00:34:14,520 --> 00:34:10,149

dedication weird catering mm-hmm can you

748

00:34:17,580 --> 00:34:14,530

top that well I can describe some of the

749

00:34:19,260 --> 00:34:17,590

interesting experience I have yes so

750

00:34:21,419 --> 00:34:19,270

when I first actually first got to him

751  
00:34:31,800 --> 00:34:21,429  
one of my first job was develop a

752  
00:34:36,060 --> 00:34:31,810  
wastewater recycling system to test the

753  
00:34:40,350 --> 00:34:36,070  
system yes I needed a 55-gallon barrel

754  
00:34:46,640 --> 00:34:40,360  
of urine and dirty shower one oh hey oh

755  
00:35:00,720 --> 00:34:57,990  
glass bottle in the men's bathroom you

756  
00:35:03,270 --> 00:35:00,730  
know I had to go around with a bottle an

757  
00:35:12,420 --> 00:35:03,280  
example is it can I have your urine

758  
00:35:14,400 --> 00:35:12,430  
please an acid document and so that's

759  
00:35:16,530 --> 00:35:14,410  
how we got it and we we did that for

760  
00:35:19,950 --> 00:35:16,540  
weeks to try to mix this and you know

761  
00:35:21,960 --> 00:35:19,960  
mixture of urine I had a fully gal oh

762  
00:35:26,670 --> 00:35:21,970  
yeah and then you used it on your system

763  
00:35:30,780 --> 00:35:26,680

yes we did yes go actually we did go all

764

00:35:39,690 --> 00:35:30,790

the way to portable water we didn't

765

00:35:41,520 --> 00:35:39,700

drink it that's pretty impressive though

766

00:35:48,570 --> 00:35:41,530

yeah that's that was that not my

767

00:35:52,470 --> 00:35:48,580

preferred job for the science things to

768

00:35:56,310 --> 00:35:52,480

get the NASA job done right yeah so yeah

769

00:35:59,520 --> 00:35:56,320

that is completely weird just but I

770

00:36:02,610 --> 00:35:59,530

guess what's not weird is using everyday

771

00:36:04,260 --> 00:36:02,620

items to get your research done cuz

772

00:36:06,510 --> 00:36:04,270

that's what you guys are gonna show us

773

00:36:09,060 --> 00:36:06,520

in the next section right so we're gonna

774

00:36:12,540 --> 00:36:09,070

move on now to present to you some of

775

00:36:14,610 --> 00:36:12,550

our genius space hacks so as I was

776

00:36:18,720 --> 00:36:14,620

describing before these guys sometimes

777

00:36:20,610 --> 00:36:18,730

encounter challenges in the lab and they

778

00:36:22,410 --> 00:36:20,620

need quick fixes or they need smart

779

00:36:25,800 --> 00:36:22,420

fixes and you don't necessarily need

780

00:36:27,060 --> 00:36:25,810

some super fancy equipment to do it you

781

00:36:30,450 --> 00:36:27,070

can invent something with a little

782

00:36:33,030 --> 00:36:30,460

creativity so Christina let's start with

783

00:36:36,390 --> 00:36:33,040

you and your flies this first hack we're

784

00:36:39,120 --> 00:36:36,400

calling Lord of the Flies sorters you

785

00:36:40,830 --> 00:36:39,130

are a flyswatter extraordinaire how many

786

00:36:42,810 --> 00:36:40,840

do you think you've sorted over the

787

00:36:45,390 --> 00:36:42,820

years well Abby that is extremely

788

00:36:49,080 --> 00:36:45,400

flattering title um one of the fly

789

00:36:51,570 --> 00:36:49,090

sorters yes I have sorted many flies in

790

00:36:53,490 --> 00:36:51,580

my lifetime I would say tens of

791

00:36:55,960 --> 00:36:53,500

thousands at least

792

00:36:59,080 --> 00:36:55,970

it's a lot to think about it's a lot of

793

00:37:01,210 --> 00:36:59,090

hours but why are you sorting flies tell

794

00:37:03,400 --> 00:37:01,220

us where this all bins that's a great

795

00:37:06,670 --> 00:37:03,410

question so why do I sort flies actually

796

00:37:08,620 --> 00:37:06,680

believe it or not flies are actually

797

00:37:11,140 --> 00:37:08,630

they're different they're not all the

798

00:37:12,340 --> 00:37:11,150

same they might all look the same you

799

00:37:14,410 --> 00:37:12,350

know with to the naked eye but they're

800

00:37:15,940 --> 00:37:14,420

actually a little bit different and we

801  
00:37:19,330 --> 00:37:15,950  
do this so that we want to make sure

802  
00:37:21,400 --> 00:37:19,340  
that we know for our experiments you

803  
00:37:23,890 --> 00:37:21,410  
know what flies goes where essentially

804  
00:37:26,770 --> 00:37:23,900  
it'll make sense and so one of the most

805  
00:37:28,360 --> 00:37:26,780  
common um I can see them actually I just

806  
00:37:29,740 --> 00:37:28,370  
realized in the close-up I see yeah

807  
00:37:32,680 --> 00:37:29,750  
they're all they're all Korean are

808  
00:37:35,590 --> 00:37:32,690  
scurrying around at top so actually or

809  
00:37:38,050 --> 00:37:35,600  
one common way that we sort is actually

810  
00:37:39,970 --> 00:37:38,060  
between males and females hmm and so

811  
00:37:41,950 --> 00:37:39,980  
they are distinctively different and

812  
00:37:45,190 --> 00:37:41,960  
we're able to see that under a

813  
00:37:47,620 --> 00:37:45,200

microscope and so normally what we do in

814

00:37:49,870 --> 00:37:47,630

the lab is that we actually take flies

815

00:37:53,980 --> 00:37:49,880

that are in vial like this and we'll

816

00:37:55,810 --> 00:37:53,990

have a tray kind of out just about this

817

00:37:58,180 --> 00:37:55,820

big about a cell phone size tray or so

818

00:38:01,110 --> 00:37:58,190

and it will actually dump out the Flies

819

00:38:02,830 --> 00:38:01,120

and they'll form a little pile and

820

00:38:07,480 --> 00:38:02,840

unfortunately we can't just tell the

821

00:38:09,100 --> 00:38:07,490

Flies like have them all lined up

822

00:38:10,750 --> 00:38:09,110

unfortunately can't even get humans to

823

00:38:14,110 --> 00:38:10,760

do that so yeah it's not gonna happen

824

00:38:16,240 --> 00:38:14,120

for flies so you know how do we do that

825

00:38:19,170 --> 00:38:16,250

well actually what we do is we use there

826

00:38:21,340 --> 00:38:19,180

it is oh yeah she's actually there I

827

00:38:23,050 --> 00:38:21,350

don't know if you can actually see it on

828

00:38:27,190 --> 00:38:23,060

there but she's actually using the heck

829

00:38:30,190 --> 00:38:27,200

you see paintbrush and you can see on

830

00:38:31,870 --> 00:38:30,200

the left is that she females I believe

831

00:38:33,610 --> 00:38:31,880

and on the right is on males

832

00:38:36,970 --> 00:38:33,620

Wow you can tell just but yeah I did so

833

00:38:38,560 --> 00:38:36,980

it's a season two I can tell but you

834

00:38:43,360 --> 00:38:38,570

learn after about a couple thousand

835

00:38:45,280 --> 00:38:43,370

flies that's all it takes a couple of

836

00:38:47,380 --> 00:38:45,290

thousand flies here there okay so you

837

00:38:49,630 --> 00:38:47,390

just need an ordinary watercolor type

838

00:38:51,160 --> 00:38:49,640

paintbrush yes this sort flies for Space

839

00:38:53,080 --> 00:38:51,170

Station experiments basically yes

840

00:38:56,110 --> 00:38:53,090

exactly and this is my favorite

841

00:38:59,080 --> 00:38:56,120

paintbrush it is not only because it's a

842

00:39:03,130 --> 00:38:59,090

beautiful color magenta color but also

843

00:39:05,200 --> 00:39:03,140

it has actually very sturdy bristles but

844

00:39:06,130 --> 00:39:05,210

actually still very soft so what we can

845

00:39:09,609 --> 00:39:06,140

do is actually

846

00:39:10,900 --> 00:39:09,619

pick up individual flies and place them

847

00:39:12,160 --> 00:39:10,910

where we want to want where we want them

848

00:39:13,989 --> 00:39:12,170

to go and we're also able to do like a

849

00:39:15,849 --> 00:39:13,999

sweeping motion and kind of move the

850

00:39:18,160 --> 00:39:15,859

Flies into different piles Wow

851  
00:39:20,950 --> 00:39:18,170  
genius maybe you don't need some

852  
00:39:23,349 --> 00:39:20,960  
specialized fly sorting device no we

853  
00:39:25,420 --> 00:39:23,359  
just need a craft store or watercolor

854  
00:39:27,489 --> 00:39:25,430  
sets if you take it from water color

855  
00:39:30,069 --> 00:39:27,499  
palettes okay and you can use that for

856  
00:39:33,150 --> 00:39:30,079  
this awesome so digital D has a question

857  
00:39:39,309 --> 00:39:33,160  
for you yes the flies ever escaped oh

858  
00:39:41,920 --> 00:39:39,319  
yes honestly yes they have escaped but

859  
00:39:44,979 --> 00:39:41,930  
mostly that's a user error more so than

860  
00:39:48,339 --> 00:39:44,989  
the Flies but what we do is we just were

861  
00:39:50,349 --> 00:39:48,349  
able to either kind of catch them and

862  
00:39:54,759 --> 00:39:50,359  
scoop them back up or sometimes we just

863  
00:39:55,989 --> 00:39:54,769

let them go farewell farewell wise I'm

864

00:39:58,539 --> 00:39:55,999

sorry you can't join us in our

865

00:39:59,829 --> 00:39:58,549

experiment right yeah all right so

866

00:40:02,440 --> 00:39:59,839

there's an experiment so that sure Mila

867

00:40:05,049 --> 00:40:02,450

was talking about a little actually work

868

00:40:05,680 --> 00:40:05,059

in her lab so she is someone I'm very

869

00:40:09,039 --> 00:40:05,690

close to

870

00:40:12,579 --> 00:40:09,049

and we sort flies all the time

871

00:40:15,130 --> 00:40:12,589

fascinating now as weird as that is I

872

00:40:21,300 --> 00:40:15,140

just want to mention that someone has

873

00:40:32,310 --> 00:40:29,190

you like to volunteer now as we move on

874

00:40:35,670 --> 00:40:32,320

to our second hack I will shout out to I

875

00:40:37,710 --> 00:40:35,680

am Leung and who mentions I put fruit

876

00:40:39,980 --> 00:40:37,720

flies to sleep with sleeping gas in

877

00:40:43,200 --> 00:40:39,990

biology class stay tuned

878

00:40:43,920 --> 00:40:43,210

here comes hack number two which we are

879

00:40:46,890 --> 00:40:43,930

calling

880

00:40:48,810 --> 00:40:46,900

nighty night flies now that's not a

881

00:40:51,210 --> 00:40:48,820

nursery rhyme that you missed in your

882

00:40:54,120 --> 00:40:51,220

you think that is about a way to make

883

00:40:56,610 --> 00:40:54,130

flies fall asleep fast right Cristina

884

00:40:58,530 --> 00:40:56,620

yes that's definitely very true so tell

885

00:41:00,750 --> 00:40:58,540

us how does that normally work in the

886

00:41:02,580 --> 00:41:00,760

lab and then what's your hack all about

887

00:41:05,580 --> 00:41:02,590

yeah so normally the lab actually what

888

00:41:08,010 --> 00:41:05,590

we do is we have a big carbon dioxide

889

00:41:10,920 --> 00:41:08,020

tank if we want we can cue up the photo

890

00:41:12,930 --> 00:41:10,930

that was a motor of you next to it I

891

00:41:17,550 --> 00:41:12,940

think so why carbon dioxide because

892

00:41:20,310 --> 00:41:17,560

that's going to so carbon dioxide will

893

00:41:22,050 --> 00:41:20,320

actually put the flies to sleep and when

894

00:41:29,190 --> 00:41:22,060

I say that I literally mean put the

895

00:41:34,290 --> 00:41:29,200

Flies to not put the Flies we want them

896

00:41:37,400 --> 00:41:34,300

to wake back up this okay and so what we

897

00:41:39,470 --> 00:41:37,410

do is so we actually have to do this

898

00:41:42,240 --> 00:41:39,480

normally this is how we're able to

899

00:41:45,210 --> 00:41:42,250

maneuver the Flies with carbon dioxide

900

00:41:46,590 --> 00:41:45,220

when they fall asleep and so so yeah

901  
00:41:48,360 --> 00:41:46,600  
that's why we have to use carbon dioxide

902  
00:41:50,370 --> 00:41:48,370  
alright but you were telling me then

903  
00:41:52,230 --> 00:41:50,380  
okay so the fly experiments go to the

904  
00:41:53,490 --> 00:41:52,240  
space station they spend perhaps a month

905  
00:41:55,770 --> 00:41:53,500  
there right I mean some of the Flies

906  
00:41:58,800 --> 00:41:55,780  
come back for you to study changes in

907  
00:42:00,600 --> 00:41:58,810  
them right ground right yes and then is

908  
00:42:02,580 --> 00:42:00,610  
that when you're gonna need a hat

909  
00:42:03,990 --> 00:42:02,590  
because you have to go fetch them yes so

910  
00:42:05,850 --> 00:42:04,000  
actually what we do is we actually have

911  
00:42:08,370 --> 00:42:05,860  
to go to Long Beach California which is

912  
00:42:09,810 --> 00:42:08,380  
down the coast of California says we're

913  
00:42:12,600 --> 00:42:09,820

up and north it's actually down further

914

00:42:14,850 --> 00:42:12,610

south and so we can't just you know

915

00:42:17,820 --> 00:42:14,860

strap a tank to our car and expect to

916

00:42:19,320 --> 00:42:17,830

drive down with it my way with eighty

917

00:42:20,850 --> 00:42:19,330

pound tank on the real way with those

918

00:42:23,160 --> 00:42:20,860

potholes in California for all of our

919

00:42:26,700 --> 00:42:23,170

Californians we all know this yeah

920

00:42:34,440 --> 00:42:31,800

fly count pun number one so no we're not

921

00:42:36,839 --> 00:42:34,450

gonna be able to do that and so what the

922

00:42:38,730 --> 00:42:36,849

genius scientists at NASA Ames Research

923

00:42:43,410 --> 00:42:38,740

Center did was actually found a way to

924

00:42:45,450 --> 00:42:43,420

create portable carbon dioxide yeah yeah

925

00:42:47,640 --> 00:42:45,460

how do you do ya know that's a great

926  
00:42:51,420 --> 00:42:47,650  
question so actually what we did was we

927  
00:42:53,849 --> 00:42:51,430  
have a bottle and this is a fly bottle

928  
00:42:56,820 --> 00:42:53,859  
that we have in the lab all the time

929  
00:42:59,250 --> 00:42:56,830  
and we hold flies and it's kind of like

930  
00:43:01,680 --> 00:42:59,260  
this vial I'm just bigger and so we can

931  
00:43:03,390 --> 00:43:01,690  
hold more flies and so what we did was

932  
00:43:05,460 --> 00:43:03,400  
we took a spare one and we filled it up

933  
00:43:08,579 --> 00:43:05,470  
with tap water just water you can find

934  
00:43:14,370 --> 00:43:08,589  
in the sink and then what we did was we

935  
00:43:19,950 --> 00:43:14,380  
actually were able to hack this by what

936  
00:43:23,220 --> 00:43:19,960  
is that dropping - antacid tablets

937  
00:43:24,690 --> 00:43:23,230  
and so yeah antacid tablets so this is

938  
00:43:26,609 --> 00:43:24,700

actually antacid tablets are used for

939

00:43:30,030 --> 00:43:26,619

indigestion there's the ones you can

940

00:43:31,560 --> 00:43:30,040

find at your local drugstore yeah these

941

00:43:33,990 --> 00:43:31,570

are just the same ones as these two

942

00:43:36,210 --> 00:43:34,000

tablets and so to demonstrate this hack

943

00:43:39,000 --> 00:43:36,220

we're actually going to be able to show

944

00:43:40,230 --> 00:43:39,010

you how the flies fall asleep but what

945

00:43:58,290 --> 00:43:40,240

I've also wanted to make sure was that

946

00:44:02,670 --> 00:43:58,300

safety first always including on set so

947

00:44:06,150 --> 00:44:02,680

we did was that we have a bottle of

948

00:44:09,570 --> 00:44:06,160

water and then now we have a vial of

949

00:44:11,609 --> 00:44:09,580

flies and so I'm gonna drop these two

950

00:44:18,480 --> 00:44:11,619

tablets and then can I get a quick

951  
00:44:23,190 --> 00:44:18,490  
countdown from the folks here there we

952  
00:44:25,859 --> 00:44:23,200  
go and you can see right and so what we

953  
00:44:27,690 --> 00:44:25,869  
do is now we have to stop it with a

954  
00:44:32,190 --> 00:44:27,700  
rubber stopper and now we're actually

955  
00:44:35,040 --> 00:44:32,200  
able to direct the carbon dioxide out

956  
00:44:36,329 --> 00:44:35,050  
the needle and what we can do is take

957  
00:44:37,470 --> 00:44:36,339  
the vial you can see they're all

958  
00:44:39,490 --> 00:44:37,480  
crawling up they're getting all excited

959  
00:44:42,100 --> 00:44:39,500  
and what

960  
00:44:44,550 --> 00:44:42,110  
do is will kind of insert it in and

961  
00:44:47,500 --> 00:44:44,560  
we'll wait for the carbon dioxide to

962  
00:44:48,790 --> 00:44:47,510  
affect them and as you can see yeah

963  
00:44:50,440 --> 00:44:48,800

they're starting to drop starting to

964

00:45:02,320 --> 00:44:50,450

drop that's pretty clear dropping like

965

00:45:06,250 --> 00:45:02,330

flies at the bottom and so yeah now we

966

00:45:10,600 --> 00:45:06,260

have about Oh 30 seconds or so to be

967

00:45:12,940 --> 00:45:10,610

able to sort the flies much like we did

968

00:45:15,130 --> 00:45:12,950

before at the hack we bring our trusty

969

00:45:17,110 --> 00:45:15,140

little paintbrush and separate the flies

970

00:45:19,120 --> 00:45:17,120

into their appropriate containers that's

971

00:45:21,040 --> 00:45:19,130

not a lot of time though no no we have

972

00:45:22,840 --> 00:45:21,050

some trained hands and the team work

973

00:45:25,570 --> 00:45:22,850

really fast and very carefully but

974

00:45:27,490 --> 00:45:25,580

accurately yeah interesting and while

975

00:45:30,130 --> 00:45:27,500

we're talking about working with flies

976  
00:45:32,920 --> 00:45:30,140  
and other organisms and putting them to

977  
00:45:34,990 --> 00:45:32,930  
sleep letting them wake up what can you

978  
00:45:37,930 --> 00:45:35,000  
guys tell us about the the precautions

979  
00:45:40,120 --> 00:45:37,940  
you take to treat animals correctly and

980  
00:45:41,980 --> 00:45:40,130  
humanely right they're their rules

981  
00:45:44,020 --> 00:45:41,990  
around that right and your work that oh

982  
00:45:46,420 --> 00:45:44,030  
yeah definitely I know you know I speak

983  
00:45:49,120 --> 00:45:46,430  
for myself in my own research but I know

984  
00:45:51,580 --> 00:45:49,130  
these folks especially Cassie here also

985  
00:45:54,370 --> 00:45:51,590  
is very familiar with this as well but

986  
00:45:57,700 --> 00:45:54,380  
yes we take the utmost precaution and

987  
00:45:59,230 --> 00:45:57,710  
most the sensitivity to the animals and

988  
00:46:00,760 --> 00:45:59,240

knowing that you know they are giving

989

00:46:05,280 --> 00:46:00,770

their lives for us to be able to learn

990

00:46:14,050 --> 00:46:07,690

chill out all day in a nice warm room

991

00:46:16,240 --> 00:46:14,060

you know they're perfectly happy and so

992

00:46:18,220 --> 00:46:16,250

we take here at NASA especially you know

993

00:46:20,980 --> 00:46:18,230

we take very much care into that and

994

00:46:23,230 --> 00:46:20,990

making sure that we don't do things just

995

00:46:26,530 --> 00:46:23,240

for fun you know we do a performant of

996

00:46:30,130 --> 00:46:26,540

science to help and help us as humans as

997

00:46:33,040 --> 00:46:30,140

well right right now thank you for that

998

00:46:35,200 --> 00:46:33,050

fascinating so I hope that the viewer

999

00:46:37,660 --> 00:46:35,210

who has done that before got a kick out

1000

00:46:40,930 --> 00:46:37,670

of seeing a NASA scientist putting flies

1001  
00:46:43,660 --> 00:46:40,940  
to sleep probably in a similar way let's

1002  
00:46:45,820 --> 00:46:43,670  
move on though to our next hack which

1003  
00:46:48,280 --> 00:46:45,830  
Cassie is gonna watch walk us through so

1004  
00:46:51,190 --> 00:46:48,290  
this is about sending spacecraft into

1005  
00:46:51,880 --> 00:46:51,200  
space such as satellites and before NASA

1006  
00:46:54,309 --> 00:46:51,890  
lon

1007  
00:46:56,079 --> 00:46:54,319  
anything it sends it up there for good

1008  
00:46:58,690 --> 00:46:56,089  
to run an experiment they're gonna test

1009  
00:47:01,329 --> 00:46:58,700  
it very carefully and give it a sort of

1010  
00:47:02,559 --> 00:47:01,339  
spacecraft checkup which is the name of

1011  
00:47:05,200 --> 00:47:02,569  
this next tack

1012  
00:47:08,620 --> 00:47:05,210  
Cassie can you tell us what's the deal

1013  
00:47:10,329 --> 00:47:08,630

and I can go into this little so when we

1014

00:47:12,370 --> 00:47:10,339

package our experiments for flight

1015

00:47:15,160 --> 00:47:12,380

they're usually contained in these nice

1016

00:47:17,140 --> 00:47:15,170

sturdy boxes so that if anybody like

1017

00:47:18,670 --> 00:47:17,150

drops it or if it needs to get like on

1018

00:47:20,529 --> 00:47:18,680

the space station there's no gravity so

1019

00:47:22,450 --> 00:47:20,539

we orient them upside down sometimes

1020

00:47:23,920 --> 00:47:22,460

they're attached to the walls sometimes

1021

00:47:24,519 --> 00:47:23,930

there are the floors there you kind of

1022

00:47:27,130 --> 00:47:24,529

go all over

1023

00:47:29,289 --> 00:47:27,140

so we pack them up in these nice sturdy

1024

00:47:31,089 --> 00:47:29,299

containers but once they're packed in

1025

00:47:32,380 --> 00:47:31,099

here we can't really check on them to

1026

00:47:37,049 --> 00:47:32,390

make sure that everything inside is

1027

00:47:39,130 --> 00:47:37,059

still working so how do we do a go/no-go

1028

00:47:40,799 --> 00:47:39,140

basically for for flight on an

1029

00:47:43,150 --> 00:47:40,809

experiment like I do I decide this is

1030

00:47:45,460 --> 00:47:43,160

good to go it's working correctly

1031

00:47:46,779 --> 00:47:45,470

of course at NASA everything has like a

1032

00:47:48,099 --> 00:47:46,789

backup and then a backup to the back

1033

00:47:50,490 --> 00:47:48,109

okay we want to make sure that we're

1034

00:47:52,420 --> 00:47:50,500

sending up a working model yeah so

1035

00:47:55,990 --> 00:47:52,430

before we actually put things together

1036

00:47:57,759 --> 00:47:56,000

we do a last minute check up and check

1037

00:48:05,740 --> 00:47:57,769

up is an accurate word because we use it

1038

00:48:07,450 --> 00:48:05,750

trusty let's go so literally if I plug

1039

00:48:09,730 --> 00:48:07,460

these into my ears I can take myself

1040

00:48:11,980 --> 00:48:09,740

stethoscope and I can listen for moving

1041

00:48:13,329 --> 00:48:11,990

parts within you know this system

1042

00:48:15,130 --> 00:48:13,339

sometimes it's a pump

1043

00:48:17,259 --> 00:48:15,140

sometimes it's check valves sometimes

1044

00:48:19,450 --> 00:48:17,269

it's gas going through the system you

1045

00:48:20,799 --> 00:48:19,460

can hear I can hear all of that by

1046

00:48:21,999 --> 00:48:20,809

moving around my stethoscope to make

1047

00:48:23,620 --> 00:48:22,009

sure everything's in working order

1048

00:48:25,299 --> 00:48:23,630

awesome yeah what do you listen like

1049

00:48:28,630 --> 00:48:25,309

what kind of sound are we listening for

1050

00:48:31,210 --> 00:48:28,640

can you yeah so like a valve will be a

1051

00:48:33,039 --> 00:48:31,220

click click like okay okay

1052

00:48:35,049 --> 00:48:33,049

literally as the valve opens you'll hear

1053

00:48:36,970 --> 00:48:35,059

it open as it closes if there's any

1054

00:48:38,740 --> 00:48:36,980

gases running for example you'll hear

1055

00:48:42,490 --> 00:48:38,750

hissing noise just like we kind of heard

1056

00:48:48,400 --> 00:48:44,410

so I'm going to that's so cool like a

1057

00:48:50,559 --> 00:48:48,410

why reinvent the wheel that thing

1058

00:48:53,980 --> 00:48:50,569

already exists to do can we call you a

1059

00:48:57,010 --> 00:48:53,990

space doctor please don't but

1060

00:48:59,230 --> 00:48:57,020

that would be too cool quite Neriah all

1061

00:49:00,850 --> 00:48:59,240

right let's move on to our next tag but

1062

00:49:03,550 --> 00:49:00,860

you're also gonna show us so give you a

1063

00:49:06,490 --> 00:49:03,560

moment to get it up here but I think

1064

00:49:08,290 --> 00:49:06,500

you're gonna tell us about spinning for

1065

00:49:12,010 --> 00:49:08,300

science and space so we're gonna call

1066

00:49:14,620 --> 00:49:12,020

this hak spin class so this is about

1067

00:49:16,330 --> 00:49:14,630

using a centrifuge right so I I worked

1068

00:49:17,920 --> 00:49:16,340

in the lab briefly I remember what that

1069

00:49:19,210 --> 00:49:17,930

is can you run us through though what a

1070

00:49:21,490 --> 00:49:19,220

centrifuge is how that works

1071

00:49:22,870 --> 00:49:21,500

sure absolutely so one of the major

1072

00:49:24,760 --> 00:49:22,880

things we have to do in research is we

1073

00:49:26,320 --> 00:49:24,770

have to be able to separate our samples

1074

00:49:28,390 --> 00:49:26,330

just like Christina uses her paintbrush

1075

00:49:31,570 --> 00:49:28,400

to separate flies we have to separate

1076  
00:49:33,100 --> 00:49:31,580  
cells from Culture Media from other like

1077  
00:49:35,890 --> 00:49:33,110  
water components and things like that

1078  
00:49:37,390 --> 00:49:35,900  
and the way we do that is on earth you

1079  
00:49:39,010 --> 00:49:37,400  
know for example if you wanted to pour a

1080  
00:49:40,870 --> 00:49:39,020  
glass of water gravity kind of does the

1081  
00:49:43,210 --> 00:49:40,880  
work for you you pour the glass of water

1082  
00:49:46,150 --> 00:49:43,220  
and you're fine in space however because

1083  
00:49:48,460 --> 00:49:46,160  
there's no gravity we have to use other

1084  
00:49:50,230 --> 00:49:48,470  
forces to drive fluids in certain

1085  
00:49:51,970 --> 00:49:50,240  
directions and one of the main ones we

1086  
00:49:54,400 --> 00:49:51,980  
use is the centrifuge centrifuge is

1087  
00:49:58,420 --> 00:49:54,410  
basically a rotary device that spins and

1088  
00:50:00,580 --> 00:49:58,430

creates a odd or a force in a single

1089

00:50:02,440 --> 00:50:00,590

direction and with that single direction

1090

00:50:05,290 --> 00:50:02,450

force you're able to separate liquids

1091

00:50:07,570 --> 00:50:05,300

based on densities or masses or move

1092

00:50:11,590 --> 00:50:07,580

fluids from one position to another okay

1093

00:50:12,340 --> 00:50:11,600

Oh on that note I think I know what

1094

00:50:14,560 --> 00:50:12,350

that's all about

1095

00:50:17,560 --> 00:50:14,570

I happen to have brought my salad

1096

00:50:20,620 --> 00:50:17,570

spinner with me today we're talking

1097

00:50:22,830 --> 00:50:20,630

about I've got my wet lettuce throw it

1098

00:50:26,340 --> 00:50:22,840

in here right I'm gonna get

1099

00:50:29,110 --> 00:50:26,350

more or less that is exactly overtime

1100

00:50:30,490 --> 00:50:29,120

throw the water against the wall that's

1101  
00:50:32,650 --> 00:50:30,500  
gonna drain out the bottom and my

1102  
00:50:36,190 --> 00:50:32,660  
lettuce is dry is that is that the same

1103  
00:50:38,020 --> 00:50:36,200  
idea same idea the difference is if I'm

1104  
00:50:39,100 --> 00:50:38,030  
separating out microscopic cells I need

1105  
00:50:47,050 --> 00:50:39,110  
something a little bit more powerful

1106  
00:50:53,230 --> 00:50:47,060  
than your arm we could you sell it yeah

1107  
00:50:55,060 --> 00:50:53,240  
all right so yeah so something a little

1108  
00:50:57,040 --> 00:50:55,070  
more powerful than this exactly but

1109  
00:50:58,960 --> 00:50:57,050  
Elad centrifuges big thing right you

1110  
00:51:01,450 --> 00:50:58,970  
brought a picture we actually do so you

1111  
00:51:03,370 --> 00:51:01,460  
can pull that up oh wow all right so

1112  
00:51:04,840 --> 00:51:03,380  
it's a it's a big machine that's not a

1113  
00:51:07,030 --> 00:51:04,850

thing that you can easily launch the

1114

00:51:09,070 --> 00:51:07,040

space station no definitely not this

1115

00:51:11,740 --> 00:51:09,080

this thing would take a way too much

1116

00:51:15,580 --> 00:51:11,750

mass and way too much space it's a big

1117

00:51:17,530 --> 00:51:15,590

machine so basically we needed a version

1118

00:51:19,120 --> 00:51:17,540

of that that we could then use in space

1119

00:51:21,340 --> 00:51:19,130

that wouldn't take up really any excess

1120

00:51:24,220 --> 00:51:21,350

space and that's our second hack all

1121

00:51:30,430 --> 00:51:24,230

right third I gotta get out so how do we

1122

00:51:32,290 --> 00:51:30,440

do that we use this is a very

1123

00:51:34,180 --> 00:51:32,300

traditional like the astronauts we use

1124

00:51:36,610 --> 00:51:34,190

they have a couple of versions of this

1125

00:51:39,220 --> 00:51:36,620

on station but they'll use it for

1126  
00:51:42,340 --> 00:51:39,230  
repairs they'll use it for repositioning

1127  
00:51:43,750 --> 00:51:42,350  
of gear on station and we decided that

1128  
00:51:45,610 --> 00:51:43,760  
we would use it as our makeshift

1129  
00:51:48,400 --> 00:51:45,620  
centrifuge all right cool and the way we

1130  
00:51:51,550 --> 00:51:48,410  
do that is we have a drill and we used a

1131  
00:51:55,140 --> 00:51:51,560  
3d printer and we printed one of these

1132  
00:51:59,010 --> 00:51:55,150  
this is basically a centrifuge rotor and

1133  
00:52:01,540 --> 00:51:59,020  
what this does get a zoom in on that

1134  
00:52:04,750 --> 00:52:01,550  
what this does is it has several

1135  
00:52:06,730 --> 00:52:04,760  
positions along the rim where we can put

1136  
00:52:08,080 --> 00:52:06,740  
sample tubes and I have an example of

1137  
00:52:10,390 --> 00:52:08,090  
the sample tube that's out right now so

1138  
00:52:12,910 --> 00:52:10,400

this is a sample tube that looks kind of

1139

00:52:16,120 --> 00:52:12,920

interesting and our sample TV fits right

1140

00:52:18,490 --> 00:52:16,130

into this rotor so if I pop it open a

1141

00:52:18,730 --> 00:52:18,500

little bit closer so I can see what I'm

1142

00:52:21,550 --> 00:52:18,740

doing

1143

00:52:24,430 --> 00:52:21,560

so if I open the lock I can pop the tube

1144

00:52:26,510 --> 00:52:24,440

right in if I lock the tube back in I

1145

00:52:27,990 --> 00:52:26,520

can then mount this whole thing

1146

00:52:31,440 --> 00:52:28,000

[Music]

1147

00:52:34,109 --> 00:52:31,450

yep I can successfully and then this if

1148

00:52:35,370 --> 00:52:34,119

I had my sample in I can literally run

1149

00:52:47,300 --> 00:52:35,380

this and I would like to run it but

1150

00:52:52,349 --> 00:52:50,339

this will spin nicely I'm gonna spin it

1151  
00:52:55,050 --> 00:52:52,359  
slowly because we're in a studio but

1152  
00:52:57,240 --> 00:52:55,060  
yeah and basically after this is

1153  
00:52:59,550 --> 00:52:57,250  
finished binning I have a photo of what

1154  
00:53:03,839 --> 00:52:59,560  
happens with some dyed liquid and what

1155  
00:53:05,370 --> 00:53:03,849  
you can see here there we go we have two

1156  
00:53:07,680 --> 00:53:05,380  
pictures this picture over here is

1157  
00:53:09,359 --> 00:53:07,690  
before the sample of centrifuge so you

1158  
00:53:11,880 --> 00:53:09,369  
can see that all the sample is in the

1159  
00:53:13,710 --> 00:53:11,890  
loading input well and then after

1160  
00:53:15,630 --> 00:53:13,720  
centrifuge the sample has moved down and

1161  
00:53:17,280 --> 00:53:15,640  
is now in the test window cool so now

1162  
00:53:19,410 --> 00:53:17,290  
from this state we could do whatever

1163  
00:53:21,870 --> 00:53:19,420

kinds of tests were looking to do let's

1164

00:53:25,640 --> 00:53:21,880

see that video of astronaut capabilities

1165

00:53:28,190 --> 00:53:25,650

using this attack on the space station

1166

00:53:31,370 --> 00:53:28,200

she is that's exactly the same thing

1167

00:53:33,980 --> 00:53:31,380

exactly the same thing same drill even

1168

00:53:39,380 --> 00:53:33,990

and she's having just as much trouble

1169

00:53:42,420 --> 00:53:39,390

and she's spinning it at full speed

1170

00:53:49,589 --> 00:53:42,430

awesome I love that that's actually in

1171

00:53:51,180 --> 00:53:49,599

use up there well we've gotta keep

1172

00:53:54,990 --> 00:53:51,190

moving because we honestly have like

1173

00:53:59,099 --> 00:53:55,000

four minutes so we want to hear about

1174

00:54:02,660 --> 00:53:59,109

Justine's hacks so this next one we're

1175

00:54:05,880 --> 00:54:02,670

gonna call take my astronaut breath away

1176  
00:54:07,740 --> 00:54:05,890  
because Justine works on keeping air

1177  
00:54:11,070 --> 00:54:07,750  
clean for astronauts on the space

1178  
00:54:13,079 --> 00:54:11,080  
station and I know that you've helped

1179  
00:54:15,480 --> 00:54:13,089  
design some systems that are already in

1180  
00:54:17,310 --> 00:54:15,490  
use up there and that you have some new

1181  
00:54:18,599 --> 00:54:17,320  
research going on so you can tell us

1182  
00:54:20,670 --> 00:54:18,609  
about can you tell us the basics what's

1183  
00:54:22,500 --> 00:54:20,680  
the deal we have to clean up the air

1184  
00:54:24,839 --> 00:54:22,510  
that they've exhaled but the astronauts

1185  
00:54:27,599 --> 00:54:24,849  
right it's so we take all the

1186  
00:54:31,380 --> 00:54:27,609  
information that you guys are doing and

1187  
00:54:33,990 --> 00:54:31,390  
learn from it and on the space station

1188  
00:54:35,760 --> 00:54:34,000

as the astronaut breathe out oxygen

1189

00:54:38,310 --> 00:54:35,770

breathe in oxygen they actually breathe

1190

00:54:40,839 --> 00:54:38,320

out carbon dioxide we need to reduce

1191

00:54:43,749 --> 00:54:40,849

that carbon dioxide in a room like this

1192

00:54:45,400 --> 00:54:43,759

a tool level that's reasonable so one

1193

00:54:48,700 --> 00:54:45,410

way we do that is we use a material

1194

00:54:52,269 --> 00:54:48,710

called solid sorbents so now I can

1195

00:54:55,059 --> 00:54:52,279

absorb now if you take a look at these

1196

00:54:57,339 --> 00:54:55,069

sponge you put this in water Juárez

1197

00:54:59,289 --> 00:54:57,349

absorb and you squeeze it out using

1198

00:55:01,630 --> 00:54:59,299

pressure or you put it in the Sun the

1199

00:55:04,450 --> 00:55:01,640

water comes back out another example of

1200

00:55:07,630 --> 00:55:04,460

Solace Orban is like that a silica gel

1201  
00:55:13,960 --> 00:55:07,640  
bag where do you find those I've seen

1202  
00:55:19,299 --> 00:55:13,970  
these in new shoe boxes you can eat your

1203  
00:55:21,670 --> 00:55:19,309  
beef jerky but do not right so we use of

1204  
00:55:23,769 --> 00:55:21,680  
materials that removes carbon dioxide

1205  
00:55:26,469 --> 00:55:23,779  
just like you water filter at home

1206  
00:55:28,930 --> 00:55:26,479  
remove contaminate from your water so in

1207  
00:55:31,150 --> 00:55:28,940  
order to remove the carbon dioxide we

1208  
00:55:35,170 --> 00:55:31,160  
have to first remove the water so we use

1209  
00:55:37,599 --> 00:55:35,180  
a similar experiment material with just

1210  
00:55:43,660 --> 00:55:37,609  
silica gel hops and same stuff in that

1211  
00:55:45,849 --> 00:55:43,670  
packet recycling right you flow air

1212  
00:55:47,859 --> 00:55:45,859  
through space stations or systems

1213  
00:55:50,589 --> 00:55:47,869

Biggers like two five gallon barrel and

1214

00:55:52,599 --> 00:55:50,599

then the air stream is dry when it's dry

1215

00:55:54,459 --> 00:55:52,609

then we remove the carbon dioxide the

1216

00:55:55,299 --> 00:55:54,469

carbon dioxide is removed by these dry

1217

00:55:57,099 --> 00:55:55,309

parts yes

1218

00:55:59,200 --> 00:55:57,109

by the second sorbets they're very cool

1219

00:56:01,209 --> 00:55:59,210

and is this reusable too if that is

1220

00:56:03,940 --> 00:56:01,219

reusable because you know you put this

1221

00:56:06,609 --> 00:56:03,950

in the Sun the water evaporate you heat

1222

00:56:09,069 --> 00:56:06,619

that up the co2 then comes off and it

1223

00:56:11,940 --> 00:56:09,079

gets recycled and converted to methane

1224

00:56:18,549 --> 00:56:11,950

and water we waste nothing on station no

1225

00:56:20,829 --> 00:56:18,559

everything is reusable regenerative

1226

00:56:22,630 --> 00:56:20,839

chemicals all right what's some of the

1227

00:56:24,009 --> 00:56:22,640

you know current research that's being

1228

00:56:25,690 --> 00:56:24,019

done on so some of the more advanced

1229

00:56:29,140 --> 00:56:25,700

research as we travel a little bit

1230

00:56:31,930 --> 00:56:29,150

further from ISS or International Space

1231

00:56:34,359 --> 00:56:31,940

Station we look at some other sorbents

1232

00:56:38,950 --> 00:56:34,369

are more effective as they use in the

1233

00:56:40,959 --> 00:56:38,960

submarines sometimes right these are

1234

00:56:43,870 --> 00:56:40,969

called liquid surface liquid sort of

1235

00:56:45,729 --> 00:56:43,880

high school so an example of this is the

1236

00:56:48,160 --> 00:56:45,739

material on top right there is a sort of

1237

00:56:50,499 --> 00:56:48,170

liquid sorban but absorbs you to when

1238

00:56:52,479 --> 00:56:50,509

it's mixed in water and when you ask you

1239

00:56:54,340 --> 00:56:52,489

to to it it actually becomes one phase

1240

00:56:59,410 --> 00:56:54,350

that's cool so this looks like oil and

1241

00:57:01,600 --> 00:56:59,420

or like salad dressing yes then it

1242

00:57:03,510 --> 00:57:01,610

absorbs you too and it becomes Mixel

1243

00:57:06,580 --> 00:57:03,520

unmixable

1244

00:57:08,530 --> 00:57:06,590

so cool so it's regenerative is regen

1245

00:57:10,900 --> 00:57:08,540

regenerative and reasonable that is the

1246

00:57:14,890 --> 00:57:10,910

keyword unbelievable

1247

00:57:17,080 --> 00:57:14,900

no i'm impressed because so clever and i

1248

00:57:20,530 --> 00:57:17,090

am so sad to say that we have to say

1249

00:57:23,260 --> 00:57:20,540

goodbye these conversations go so fast

1250

00:57:25,450 --> 00:57:23,270

every time but thank you all of you for

1251

00:57:27,520 --> 00:57:25,460

joining us and thank you everybody for

1252

00:57:29,830 --> 00:57:27,530

watching this has been NASA in Silicon

1253

00:57:31,930 --> 00:57:29,840

Valley live as we said we are a

1254

00:57:33,850 --> 00:57:31,940

conversational show about all the cool

1255

00:57:37,630 --> 00:57:33,860

work going on at NASA's Ames Research

1256

00:57:40,500 --> 00:57:37,640

Center so tune in next time we will be

1257

00:57:44,020 --> 00:57:40,510

back on September 27th to talk about

1258

00:57:46,480 --> 00:57:44,030

videogames in space so join us then you

1259

00:57:48,610 --> 00:57:46,490

can watch us on Twitch YouTube Facebook

1260

00:57:52,150 --> 00:57:48,620

and NASA TV and you can catch the audio

1261

00:57:53,950 --> 00:57:52,160

version on our podcast until then thank