



1
00:00:23,060 --> 00:00:21,019
oh hi f e that's life or so they say did

2
00:00:25,070 --> 00:00:23,070
you know the study of life is the actual

3
00:00:26,929 --> 00:00:25,080
definition of the word biology and

4
00:00:29,329 --> 00:00:26,939
that's what we're focusing on on this

5
00:00:32,120 --> 00:00:29,339
episode biological research

6
00:00:34,250 --> 00:00:32,130
now this can range from plant growth to

7
00:00:36,979 --> 00:00:34,260
cell communication from bacterial

8
00:00:40,160 --> 00:00:36,989
virulence to actual strength and human

9
00:00:42,979 --> 00:00:40,170
bones by studying the science of biology

10
00:00:46,310 --> 00:00:42,989
or life in the microgravity environment

11
00:00:49,220 --> 00:00:46,320
on the International Space Station we've

12
00:00:51,439 --> 00:00:49,230
gained access to a whole new world of

13
00:00:54,770 --> 00:00:51,449

incredible science possibilities that

14

00:00:57,020 --> 00:00:54,780

didn't exist before join me as we go

15

00:00:59,959 --> 00:00:57,030

onboard the ISS to learn more about

16

00:01:02,959 --> 00:00:59,969

biological research in microgravity hi

17

00:01:04,160 --> 00:01:02,969

I'm NASA astronaut Tracy Dyson welcome

18

00:01:08,090 --> 00:01:04,170

to station life

19

00:01:11,120 --> 00:01:08,100

is it a $\frac{2}{4}$ of equation that we use our

20

00:01:11,360 --> 00:01:11,130

sleep live at four six four hours right

21

00:01:13,880 --> 00:01:11,370

now

22

00:01:15,320 --> 00:01:13,890

oh geez thank you okay Tracy we copy and

23

00:01:19,430 --> 00:01:15,330

that good information we'll pass it

24

00:01:21,290 --> 00:01:19,440

along in this episode of station life

25

00:01:23,330 --> 00:01:21,300

we're going to look at biological

26
00:01:26,030 --> 00:01:23,340
research onboard the International Space

27
00:01:28,010 --> 00:01:26,040
Station we'll uncover some incredible

28
00:01:31,490 --> 00:01:28,020
breakthroughs made in the treatment of

29
00:01:33,530 --> 00:01:31,500
Duchenne muscular dystrophy we'll look

30
00:01:35,600 --> 00:01:33,540
at studies of protein assemblies that

31
00:01:38,630 --> 00:01:35,610
will help us figure out how Alzheimer's

32
00:01:40,700 --> 00:01:38,640
develops will chat with NASA's chief

33
00:01:43,070 --> 00:01:40,710
astronaut Chris Cassidy about the

34
00:01:45,560 --> 00:01:43,080
biological research capabilities aboard

35
00:01:47,510 --> 00:01:45,570
the ISS and we'll look at ongoing

36
00:01:49,790 --> 00:01:47,520
studies to further understand plant

37
00:01:51,650 --> 00:01:49,800
growth in a weightless environment so

38
00:01:56,700 --> 00:01:51,660

strap yourself in because it's going to

39

00:01:56,710 --> 00:02:03,750

Oh

40

00:02:09,609 --> 00:02:06,880

DMD or Duchenne muscular dystrophy is

41

00:02:12,400 --> 00:02:09,619

the most common muscle disease affecting

42

00:02:15,370 --> 00:02:12,410

young boys it affects about one in 3,600

43

00:02:18,340 --> 00:02:15,380

it's an incurable condition and it

44

00:02:22,030 --> 00:02:18,350

results in really muscle weakness that

45

00:02:24,160 --> 00:02:22,040

worsens over a boy's life time typically

46

00:02:27,690 --> 00:02:24,170

boys lose their ability to walk around

47

00:02:30,310 --> 00:02:27,700

age 12 as boys go through adolescence

48

00:02:32,229 --> 00:02:30,320

they have usually additional

49

00:02:35,470 --> 00:02:32,239

complications related to their lung or

50

00:02:37,240 --> 00:02:35,480

pulmonary health as well as more often

51
00:02:39,790 --> 00:02:37,250
than not will develop cardiac disease

52
00:02:41,860 --> 00:02:39,800
heart disease and unfortunately most

53
00:02:45,250 --> 00:02:41,870
boys will pass away in their 20s from

54
00:02:52,760 --> 00:02:45,260
complications such as pneumonia or heart

55
00:02:57,170 --> 00:02:55,160
in order to combat diseases like this we

56
00:02:59,030 --> 00:02:57,180
have to study the structure of proteins

57
00:03:01,820 --> 00:02:59,040
that are associated with that particular

58
00:03:04,010 --> 00:03:01,830
disease in order to do that we first

59
00:03:06,890 --> 00:03:04,020
must crystallize the protein that

60
00:03:09,440 --> 00:03:06,900
crystal is basically millions of copies

61
00:03:11,690 --> 00:03:09,450
of that same protein aligned like a row

62
00:03:14,060 --> 00:03:11,700
of bricks on a wall but in three

63
00:03:15,290 --> 00:03:14,070

dimensions but here's the problem when

64

00:03:17,840 --> 00:03:15,300

we try to grow a crystal on earth

65

00:03:19,820 --> 00:03:17,850

gravity can affect the way the molecules

66

00:03:22,220 --> 00:03:19,830

become aligned on the crystal surface

67

00:03:25,280 --> 00:03:22,230

and that affects the overall quality of

68

00:03:26,990 --> 00:03:25,290

the crystal the ideal environment to

69

00:03:28,940 --> 00:03:27,000

grow a more perfect crystal would be a

70

00:03:31,520 --> 00:03:28,950

lab that we could have up in space

71

00:03:34,010 --> 00:03:31,530

orbiting the globe so that we are free

72

00:03:35,180 --> 00:03:34,020

of Earth's gravity luckily we have one

73

00:03:40,100 --> 00:03:35,190

of those with the International Space

74

00:03:43,910 --> 00:03:40,110

Station since 2003 the japan aerospace

75

00:03:46,160 --> 00:03:43,920

exploration agency has conducted more

76

00:03:48,620 --> 00:03:46,170

than 16 sessions of the protein crystal

77

00:03:50,690 --> 00:03:48,630

growth experiments on both the

78

00:03:53,000 --> 00:03:50,700

International Space Station in

79

00:03:55,790 --> 00:03:53,010

microgravity the crystals grow much more

80

00:03:58,070 --> 00:03:55,800

slowly but the molecules have more time

81

00:03:59,840 --> 00:03:58,080

to get perfectly arranged on the surface

82

00:04:02,270 --> 00:03:59,850

of the crystal and that gives us much

83

00:04:04,940 --> 00:04:02,280

better data

84

00:04:07,570 --> 00:04:04,950

one of the most promising results has

85

00:04:09,230 --> 00:04:07,580

been gained by studying a protein

86

00:04:13,130 --> 00:04:09,240

associated with Duchenne muscular

87

00:04:16,220 --> 00:04:13,140

dystrophy studying this protein the to a

88

00:04:18,949 --> 00:04:16,230

huge discovery like a ki fittingly

89

00:04:23,120 --> 00:04:18,959

turkey home we are able to design that

90

00:04:25,820 --> 00:04:23,130

grab that perfectly by - this protein by

91

00:04:28,100 --> 00:04:25,830

knowing the shape of that keyhole we can

92

00:04:31,070 --> 00:04:28,110

tailor make a drug to fit into a

93

00:04:35,270 --> 00:04:31,080

specific location of the protein what

94

00:04:39,650 --> 00:04:35,280

this means is we may be able to slow

95

00:04:43,730 --> 00:04:39,660

that is by half instead of being in a

96

00:04:47,540 --> 00:04:43,740

wheelchair at 12 we might be able to

97

00:04:50,780 --> 00:04:47,550

push that pace to change hi

98

00:04:54,560 --> 00:04:50,790

instead of being dependent upon the

99

00:04:58,420 --> 00:04:54,570

dissipation at 20 years or it need to be

100

00:05:02,450 --> 00:04:58,430

40 what we're talking about is

101
00:05:08,480 --> 00:05:02,460
potentially doubling the lifespan of

102
00:05:12,250 --> 00:05:08,490
many of these rehabilitation and it's

103
00:05:15,740 --> 00:05:12,260
all because of such a potentially

104
00:05:18,170 --> 00:05:15,750
accorded to us by the International

105
00:05:20,540 --> 00:05:18,180
Space Station this research is really

106
00:05:22,280 --> 00:05:20,550
just in its infancy there are literally

107
00:05:24,710 --> 00:05:22,290
thousands of other proteins through

108
00:05:26,390 --> 00:05:24,720
structures we need to determine and the

109
00:05:28,130 --> 00:05:26,400
International Space Station is going to

110
00:05:30,140 --> 00:05:28,140
provide a platform where we can

111
00:05:32,000 --> 00:05:30,150
hopefully grow much better crystals that

112
00:05:33,980 --> 00:05:32,010
allow us to get structures and to learn

113
00:05:36,950 --> 00:05:33,990

more about how these molecules function

114

00:05:39,410 --> 00:05:36,960

in our body and back bacteria or in

115

00:05:41,120 --> 00:05:39,420

viruses we're doing this research not

116

00:05:42,320 --> 00:05:41,130

just for ourselves or our children but

117

00:05:44,540 --> 00:05:42,330

for generations to come

118

00:05:45,890 --> 00:05:44,550

many of the protein structures that will

119

00:05:57,180 --> 00:05:45,900

be determined wouldn't be possible

120

00:06:01,990 --> 00:05:59,530

I'm hoping that those trials will be

121

00:06:04,480 --> 00:06:02,000

successful but they will tell us yes

122

00:06:06,550 --> 00:06:04,490

there is a way that we can keep these

123

00:06:08,230 --> 00:06:06,560

boys stronger for a longer period of

124

00:06:09,760 --> 00:06:08,240

time that we can help their heart and

125

00:06:11,379 --> 00:06:09,770

pulmonary function that they can live

126
00:06:13,330 --> 00:06:11,389
longer that they can grow up and go to

127
00:06:35,500 --> 00:06:13,340
school and do the things that we all

128
00:06:35,510 --> 00:07:08,570
you

129
00:07:13,829 --> 00:07:11,339
welcome back we already mentioned that

130
00:07:16,139 --> 00:07:13,839
the ISS is a great platform to conduct

131
00:07:19,079 --> 00:07:16,149
biological research in microgravity

132
00:07:21,209 --> 00:07:19,089
in fact by studying life off the earth

133
00:07:23,309 --> 00:07:21,219
we're making huge breakthroughs in

134
00:07:26,459 --> 00:07:23,319
training today's most complex problems

135
00:07:28,649 --> 00:07:26,469
right here on the earth one of the

136
00:07:30,420 --> 00:07:28,659
exciting experiments ongoing right now

137
00:07:32,429 --> 00:07:30,430
onboard the International Space Station

138
00:07:35,339 --> 00:07:32,439

is called nano racks

139

00:07:38,639 --> 00:07:35,349

sable which stands for self-assembly in

140

00:07:41,519 --> 00:07:38,649

biology and origin of life a study into

141

00:07:43,709 --> 00:07:41,529

Alzheimer's that's a mouthful this

142

00:07:45,839 --> 00:07:43,719

experiment observes how proteins

143

00:07:49,290 --> 00:07:45,849

assemble in microgravity and how

144

00:07:51,149 --> 00:07:49,300

Alzheimer's progresses here's a very

145

00:07:53,850 --> 00:07:51,159

important video that will tell you all

146

00:07:56,909 --> 00:07:53,860

about it Alzheimer's disease is a global

147

00:07:58,679 --> 00:07:56,919

problem in the United States alone more

148

00:08:01,739 --> 00:07:58,689

than 5 million people have the disease

149

00:08:04,529 --> 00:08:01,749

and a new diagnosis is made every 67

150

00:08:07,079 --> 00:08:04,539

seconds numbers that are just a fraction

151
00:08:09,149 --> 00:08:07,089
of worldwide totals among medical

152
00:08:11,279 --> 00:08:09,159
researchers Alzheimer's is a top

153
00:08:13,110 --> 00:08:11,289
priority researchers working with

154
00:08:15,480 --> 00:08:13,120
astronauts on the International Space

155
00:08:17,369 --> 00:08:15,490
Station are embarking on a mission to

156
00:08:19,290 --> 00:08:17,379
discover the origin of Alzheimer's

157
00:08:20,999 --> 00:08:19,300
although the details are still a little

158
00:08:22,679 --> 00:08:21,009
fuzzy researchers believe that

159
00:08:25,230 --> 00:08:22,689
Alzheimer's and similar diseases

160
00:08:27,179 --> 00:08:25,240
advanced when certain proteins in the

161
00:08:29,279 --> 00:08:27,189
brain assemble themselves into long

162
00:08:30,809 --> 00:08:29,289
fibers that accumulate and ultimately

163
00:08:32,550 --> 00:08:30,819

strangle nerve cells in the brain

164

00:08:34,379 --> 00:08:32,560

they're sort of like the crankcase

165

00:08:36,449 --> 00:08:34,389

sludge of the human body

166

00:08:38,819 --> 00:08:36,459

explains Dan Woodard of NASA's Kennedy

167

00:08:40,889 --> 00:08:38,829

Space Center the fibers are not active

168

00:08:42,600 --> 00:08:40,899

so they'll be around forever because

169

00:08:43,230 --> 00:08:42,610

your body doesn't have any way to get

170

00:08:45,660 --> 00:08:43,240

rid of them

171

00:08:47,490 --> 00:08:45,670

these fibers take decades to form and

172

00:08:50,340 --> 00:08:47,500

accumulate hence the link between

173

00:08:50,850 --> 00:08:50,350

Alzheimer's and aging in Laboratories on

174

00:08:52,679 --> 00:08:50,860

earth

175

00:08:54,870 --> 00:08:52,689

researchers have figured out how to make

176
00:08:56,879 --> 00:08:54,880
protein fibers accumulate more quickly

177
00:08:58,790 --> 00:08:56,889
so they can study the process without

178
00:09:01,439 --> 00:08:58,800
waiting so long on the space station

179
00:09:03,150 --> 00:09:01,449
accumulated fibers do not collapse under

180
00:09:05,069 --> 00:09:03,160
their own weight which makes the station

181
00:09:07,530 --> 00:09:05,079
an even better place to study them a

182
00:09:09,870 --> 00:09:07,540
four inch cube containing the experiment

183
00:09:12,000 --> 00:09:09,880
which was selected in an ISS research

184
00:09:13,650 --> 00:09:12,010
contest by space Florida and

185
00:09:15,960 --> 00:09:13,660
racks and built at the Florida Institute

186
00:09:17,940 --> 00:09:15,970
of Technology blasted off to the

187
00:09:20,490 --> 00:09:17,950
International Space Station on board the

188
00:09:23,840 --> 00:09:20,500

SpaceX five cargo resupply mission early

189

00:09:26,370 --> 00:09:23,850

2015 the experiment itself sable or

190

00:09:28,680 --> 00:09:26,380

self-assembly in biology and the origin

191

00:09:30,780 --> 00:09:28,690

of life a study into Alzheimer's will be

192

00:09:33,300 --> 00:09:30,790

fully automated however observations

193

00:09:35,250 --> 00:09:33,310

from this experiment alone won't lead

194

00:09:37,170 --> 00:09:35,260

directly to the discovery of a cure

195

00:09:38,640 --> 00:09:37,180

Sabol is geared more towards

196

00:09:41,070 --> 00:09:38,650

understanding the way that Alzheimer's

197

00:09:43,230 --> 00:09:41,080

progresses not towards creating a pill

198

00:09:45,360 --> 00:09:43,240

to stop it from happening although this

199

00:09:47,250 --> 00:09:45,370

experiment is only the first and what

200

00:09:49,380 --> 00:09:47,260

will surely be a series water'd is

201
00:09:51,030 --> 00:09:49,390
optimistic that it could be an extremely

202
00:09:53,340 --> 00:09:51,040
valuable learning experience

203
00:09:55,230 --> 00:09:53,350
everybody wants a cure but without

204
00:09:57,720 --> 00:09:55,240
knowing the actual cause of the disease

205
00:09:59,460 --> 00:09:57,730
you're basically shooting in the dark we

206
00:10:01,170 --> 00:09:59,470
don't understand the true mechanism of

207
00:10:02,940 --> 00:10:01,180
the disease if we're lucky

208
00:10:05,100 --> 00:10:02,950
then we'll find out whether proteins

209
00:10:06,570 --> 00:10:05,110
will aggregate in space only in

210
00:10:08,670 --> 00:10:06,580
weightlessness can you produce an

211
00:10:10,560 --> 00:10:08,680
environment free of convection so you

212
00:10:12,810 --> 00:10:10,570
can see whether they form on their own

213
00:10:15,600 --> 00:10:12,820

we expect to learn incrementally from

214

00:10:17,550 --> 00:10:15,610

this eventually projects like Sabol

215

00:10:19,380 --> 00:10:17,560

could lead to the discovery of a method

216

00:10:21,810 --> 00:10:19,390

to slow down the rate at which the

217

00:10:24,450 --> 00:10:21,820

harmful fibers grow thereby opening a

218

00:10:26,280 --> 00:10:24,460

window for a cure after the samples are

219

00:10:28,230 --> 00:10:26,290

returned to earth and are examined

220

00:10:30,270 --> 00:10:28,240

underneath an atomic force microscope

221

00:10:32,130 --> 00:10:30,280

Woodard speculates that the cause of

222

00:10:34,500 --> 00:10:32,140

Alzheimer's could surprise us by being

223

00:10:37,170 --> 00:10:34,510

deceptively simple there have to be

224

00:10:39,360 --> 00:10:37,180

chemicals or processes that hinder or

225

00:10:41,580 --> 00:10:39,370

encourage the growth of protein fibers

226

00:10:43,980 --> 00:10:41,590

it may be something as simple as

227

00:10:46,920 --> 00:10:43,990

temperature or salt concentration of the

228

00:10:48,960 --> 00:10:46,930

fluid in the brain strange but true the

229

00:10:51,510 --> 00:10:48,970

key to unraveling the mysterious cause

230

00:10:53,310 --> 00:10:51,520

of Alzheimer's disease may not lie in

231

00:10:55,530 --> 00:10:53,320

the recesses of the human brain but

232

00:10:58,230 --> 00:10:55,540

rather in the weightless expanse of

233

00:11:00,450 --> 00:10:58,240

space if an answer is ultimately found

234

00:11:03,090 --> 00:11:00,460

it could very well spring from the

235

00:11:32,110 --> 00:11:03,100

microgravity of Earth orbit off the

236

00:11:37,430 --> 00:11:34,879

you would not believe who we have with

237

00:11:39,740 --> 00:11:37,440

us today I mean this guy not only flew

238

00:11:41,180 --> 00:11:39,750

on the shuttle not only did a six-month

239

00:11:41,990 --> 00:11:41,190

increment onboard the International

240

00:11:45,230 --> 00:11:42,000

Space Station

241

00:11:48,019 --> 00:11:45,240

not only did six EVs but the guys are

242

00:11:50,990 --> 00:11:48,029

captain in the US Navy a former Navy

243

00:11:52,939 --> 00:11:51,000

SEAL he ran swam and biked the Ironman

244

00:11:56,060 --> 00:11:52,949

and he is tougher than Chuck Norris and

245

00:11:58,069 --> 00:11:56,070

the Six Million Dollar Man combine okay

246

00:12:00,079 --> 00:11:58,079

Tracy let's go back come on out my

247

00:12:03,740 --> 00:12:00,089

settle down he's awesome the chief

248

00:12:06,199 --> 00:12:03,750

astronaut hmm it means he's my boss hey

249

00:12:09,379 --> 00:12:06,209

man hey so good to have you for us today

250

00:12:09,740 --> 00:12:09,389

I am like beyond excited to have you on

251
00:12:11,540 --> 00:12:09,750
the show

252
00:12:13,370 --> 00:12:11,550
it's really cool to be here and be part

253
00:12:16,430 --> 00:12:13,380
of it yeah cool well I'm glad you're

254
00:12:18,379 --> 00:12:16,440
pumped up too you know I think that not

255
00:12:20,960 --> 00:12:18,389
everybody out there knows that you just

256
00:12:23,840 --> 00:12:20,970
became the chief astronaut and you are

257
00:12:26,269 --> 00:12:23,850
no stranger to being a leader amongst

258
00:12:27,800 --> 00:12:26,279
people you were quite a leader during

259
00:12:30,079 --> 00:12:27,810
the time you were a Navy SEAL

260
00:12:33,980 --> 00:12:30,089
so I gotta wonder is there are there any

261
00:12:36,650 --> 00:12:33,990
comparisons between being a Navy SEAL

262
00:12:39,079 --> 00:12:36,660
leader and an astronaut leader oh man

263
00:12:40,550 --> 00:12:39,089

it's that's it that's a good question I

264

00:12:43,160 --> 00:12:40,560

think it's it's different in each

265

00:12:46,389 --> 00:12:43,170

environment when I was a young 22 23

266

00:12:49,189 --> 00:12:46,399

year old guy it was fun to lead

267

00:12:50,990 --> 00:12:49,199

sledgehammer karien Navy SEALs and I

268

00:12:54,430 --> 00:12:51,000

don't think that's quite the kitten book

269

00:12:57,920 --> 00:12:54,440

the clientele we have here it is

270

00:12:59,540 --> 00:12:57,930

but yeah it's all good either way so

271

00:13:01,030 --> 00:12:59,550

talk about Chris Cassidy is the

272

00:13:04,160 --> 00:13:01,040

scientist on board the space station

273

00:13:07,069 --> 00:13:04,170

yeah that's that's uh almost doesn't

274

00:13:08,990 --> 00:13:07,079

sound right because we don't feel least

275

00:13:11,930 --> 00:13:09,000

when I was there I didn't feel like the

276

00:13:14,540 --> 00:13:11,940

expert scientist I felt like the person

277

00:13:16,370 --> 00:13:14,550

who was executing the plan for the

278

00:13:17,720 --> 00:13:16,380

expert scientists and they have really

279

00:13:19,579 --> 00:13:17,730

good procedures that tell us exactly

280

00:13:22,189 --> 00:13:19,589

exactly what to do because there's so

281

00:13:24,319 --> 00:13:22,199

many things that are there for us to

282

00:13:26,780 --> 00:13:24,329

help with and I don't know if you felt

283

00:13:28,250 --> 00:13:26,790

the same way it's just lots of different

284

00:13:30,500 --> 00:13:28,260

experiments there's no way we could know

285

00:13:31,520 --> 00:13:30,510

at all as as the astronaut absolutely

286

00:13:34,280 --> 00:13:31,530

and there you know

287

00:13:35,750 --> 00:13:34,290

any there was actually no typical day on

288

00:13:37,430 --> 00:13:35,760

or the International Space Station

289

00:13:39,470 --> 00:13:37,440

you're either doing maintenance you're

290

00:13:41,000 --> 00:13:39,480

doing science you're getting ready for a

291

00:13:42,530 --> 00:13:41,010

spacewalk or maybe a visiting vehicle

292

00:13:44,450 --> 00:13:42,540

and you got a grapple it with the

293

00:13:47,450 --> 00:13:44,460

robotic arm so our brains are constantly

294

00:13:50,270 --> 00:13:47,460

going and that's why like chris says you

295

00:13:51,800 --> 00:13:50,280

you end up but you can't be an expert on

296

00:13:53,750 --> 00:13:51,810

any one thing but you just got to be

297

00:13:55,550 --> 00:13:53,760

able to absorb information a lot of it

298

00:13:57,650 --> 00:13:55,560

in a short period of time yep and

299

00:13:59,660 --> 00:13:57,660

there's this pressure of you know people

300

00:14:02,120 --> 00:13:59,670

have put a lot of their heart blood and

301
00:14:04,010 --> 00:14:02,130
soul into that thing whatever the thing

302
00:14:07,370 --> 00:14:04,020
is whatever the experiment or equipment

303
00:14:09,260 --> 00:14:07,380
or you name it and there's this

304
00:14:10,850 --> 00:14:09,270
underlying pressure of I don't want to

305
00:14:12,980 --> 00:14:10,860
be the guy that screws this thing up

306
00:14:15,470 --> 00:14:12,990
today on station life we're talking

307
00:14:16,940 --> 00:14:15,480
about biological research can you think

308
00:14:18,470 --> 00:14:16,950
of it can you remember back to any of

309
00:14:21,890 --> 00:14:18,480
the experiments that you did that that

310
00:14:24,170 --> 00:14:21,900
had a biology focus on them yeah what

311
00:14:27,290 --> 00:14:24,180
sticks most in my mind were the ones of

312
00:14:29,600 --> 00:14:27,300
which I was the subject and I was part

313
00:14:32,150 --> 00:14:29,610

of one that called Pro K which was put

314

00:14:34,910 --> 00:14:32,160

protein to potassium ratio in my diet

315

00:14:36,920 --> 00:14:34,920

and we would bury we would do this

316

00:14:38,860 --> 00:14:36,930

particular diet for four days at a time

317

00:14:40,850 --> 00:14:38,870

and take blood and urine samples

318

00:14:42,500 --> 00:14:40,860

throughout those four days I don't know

319

00:14:45,980 --> 00:14:42,510

if that was one when you're up there yes

320

00:14:49,850 --> 00:14:45,990

I have very fond memories of Pro K but

321

00:14:52,540 --> 00:14:49,860

also I I was so I like Chris said we've

322

00:14:54,650 --> 00:14:52,550

got this four-day menu that we eat

323

00:14:57,410 --> 00:14:54,660

specifically and you haven't be late if

324

00:14:59,120 --> 00:14:57,420

you have to eat all of the stuff and oh

325

00:15:00,950 --> 00:14:59,130

you know you can't under eating there's

326

00:15:02,690 --> 00:15:00,960

you can't over it you got to eat only

327

00:15:04,100 --> 00:15:02,700

that that was the hardest part I thought

328

00:15:06,140 --> 00:15:04,110

I thought it was you getting on the

329

00:15:08,150 --> 00:15:06,150

right glide slope about dinner lunchtime

330

00:15:10,070 --> 00:15:08,160

to be done when you and so you weren't

331

00:15:11,480 --> 00:15:10,080

at seven o'clock going oh my god I'm so

332

00:15:13,250 --> 00:15:11,490

hungry that's when it was interesting

333

00:15:15,800 --> 00:15:13,260

experiments where you you eat food for a

334

00:15:18,560 --> 00:15:15,810

week you draw your blood and then you

335

00:15:22,790 --> 00:15:18,570

use some instruments onboard the station

336

00:15:25,310 --> 00:15:22,800

like a centrifuge yeah and a minus

337

00:15:26,840 --> 00:15:25,320

eighty degree freezer to store the

338

00:15:28,579 --> 00:15:26,850

samples and then we wait for it I

339

00:15:31,640 --> 00:15:28,589

remember there was there's very specific

340

00:15:33,770 --> 00:15:31,650

times on when it comes out of you until

341

00:15:36,200 --> 00:15:33,780

how long it has to rest and then go in

342

00:15:39,260 --> 00:15:36,210

the centrifuge and and there there is

343

00:15:41,420 --> 00:15:39,270

very regimented you couldn't dilly-dally

344

00:15:44,000 --> 00:15:41,430

with any of those steps to get it from

345

00:15:44,889 --> 00:15:44,010

you to the centrifuge to the freezer our

346

00:15:46,989 --> 00:15:44,899

space station

347

00:15:50,309 --> 00:15:46,999

terms of life we have an environmental

348

00:15:53,920 --> 00:15:50,319

control system that takes water and

349

00:15:55,329 --> 00:15:53,930

cycles it everything from sweat to urine

350

00:15:57,460 --> 00:15:55,339

and turns it into water that we actually

351

00:16:02,590 --> 00:15:57,470

drink to polite it turns yesterday's

352

00:16:05,679 --> 00:16:02,600

coffee I was I was just you know you're

353

00:16:07,359 --> 00:16:05,689

right I'm good to to polite but that's

354

00:16:10,179 --> 00:16:07,369

the other part about the station that

355

00:16:12,040 --> 00:16:10,189

actually I mean it's biology to where

356

00:16:15,639 --> 00:16:12,050

we're taking we're learning how to

357

00:16:17,139 --> 00:16:15,649

recycle yeah things recycled life water

358

00:16:19,030 --> 00:16:17,149

is life and and if we're gonna go

359

00:16:21,309 --> 00:16:19,040

further that's so critical yeah they're

360

00:16:24,119 --> 00:16:21,319

going further than pushing the

361

00:16:26,679 --> 00:16:24,129

boundaries of where we are now yes so I

362

00:16:28,359 --> 00:16:26,689

just want to say Chris it's been a real

363

00:16:30,699 --> 00:16:28,369

pleasure talking with you and it's been

364

00:16:33,009 --> 00:16:30,709

a real honor to have you on station life

365

00:16:34,929 --> 00:16:33,019

and we'd love to have you again sometime

366

00:16:36,519 --> 00:16:34,939

but thank you so much for sharing your

367

00:16:39,460 --> 00:16:36,529

thoughts and your experiences with us

368

00:16:46,780 --> 00:16:39,470

here today absolutely cool all right man

369

00:16:48,280 --> 00:16:46,790

thanks a lot you bet thank you hey it's

370

00:16:49,689 --> 00:16:48,290

me Destin from smarter every day on

371

00:16:51,819 --> 00:16:49,699

YouTube think about this if we're going

372

00:16:53,379 --> 00:16:51,829

to go to Mars we've got to take food got

373

00:16:55,569 --> 00:16:53,389

to take water these are important things

374

00:16:56,829 --> 00:16:55,579

right well there's a system on the

375

00:16:59,379 --> 00:16:56,839

international space station called

376

00:17:02,049 --> 00:16:59,389

Equus what they do is when they drink

377

00:17:04,299 --> 00:17:02,059

the water they go you know use it in

378

00:17:06,010 --> 00:17:04,309

their body it goes out their body in the

379

00:17:08,500 --> 00:17:06,020

form of urine and then it goes through a

380

00:17:10,600 --> 00:17:08,510

system called ekeus equalists can take

381

00:17:12,939 --> 00:17:10,610

urine and turn it back into potable

382

00:17:14,470 --> 00:17:12,949

water and they can drink it again so

383

00:17:15,429 --> 00:17:14,480

right now on the international space

384

00:17:17,079 --> 00:17:15,439

station we're kind of figuring this

385

00:17:20,019 --> 00:17:17,089

stuff out for every one gallon of water

386

00:17:21,669 --> 00:17:20,029

that they need to use 65% of it comes

387

00:17:24,100 --> 00:17:21,679

from Equalists they're drinking their

388

00:17:26,490 --> 00:17:24,110

pee the rest of it they're using fresh

389

00:17:29,560 --> 00:17:26,500

water I thought I was pretty cool you

390

00:17:32,350 --> 00:17:29,570

know one of the most important things to

391

00:17:35,320 --> 00:17:32,360

a human in space as you guessed it food

392

00:17:38,230 --> 00:17:35,330

but getting food to space is no small

393

00:17:40,600 --> 00:17:38,240

task so if we could grow our own food in

394

00:17:42,549 --> 00:17:40,610

space that would open up all kinds of

395

00:17:46,180 --> 00:17:42,559

possibilities for human space

396

00:17:47,790 --> 00:17:46,190

exploration recently astronauts aboard

397

00:17:50,700 --> 00:17:47,800

the ISS ate

398

00:17:52,799 --> 00:17:50,710

lettuce big deal right heck yeah wish I

399

00:17:55,260 --> 00:17:52,809

had it actually it was the first time

400

00:17:58,230 --> 00:17:55,270

that astronauts consumed lettuce grown

401
00:18:01,230 --> 00:17:58,240
in space understanding how to grow food

402
00:18:04,169 --> 00:18:01,240
in microgravity is absolutely essential

403
00:18:05,820 --> 00:18:04,179
for future long-duration missions it can

404
00:18:08,070 --> 00:18:05,830
also help us to grow plants in

405
00:18:10,140 --> 00:18:08,080
challenging environments right here on

406
00:18:12,330 --> 00:18:10,150
the earth take a look at how our

407
00:18:19,020 --> 00:18:12,340
European partners are tackling the

408
00:18:20,850 --> 00:18:19,030
challenges of growing food in space well

409
00:18:23,100 --> 00:18:20,860
everybody knows that blood plants are

410
00:18:25,020 --> 00:18:23,110
important for the daily life on the

411
00:18:27,240 --> 00:18:25,030
earth for the daily life of the human

412
00:18:30,000 --> 00:18:27,250
being for the same reason really plants

413
00:18:32,130 --> 00:18:30,010

are important for any adventure of a

414

00:18:35,610 --> 00:18:32,140

space exploration that the human being

415

00:18:38,520 --> 00:18:35,620

can undertake plants produce oxygen

416

00:18:42,900 --> 00:18:38,530

which is an essential component of for

417

00:18:45,180 --> 00:18:42,910

our life plants produce water which is

418

00:18:48,090 --> 00:18:45,190

also essential plants produce

419

00:18:50,010 --> 00:18:48,100

fundamental food we are now using the

420

00:18:52,260 --> 00:18:50,020

fantastic resources offered by the

421

00:18:56,400 --> 00:18:52,270

International Space Station which are

422

00:18:58,590 --> 00:18:56,410

just being now fully available from the

423

00:19:00,060 --> 00:18:58,600

even in the case of Europe with

424

00:19:02,060 --> 00:19:00,070

implementation of the Columbus

425

00:19:06,450 --> 00:19:02,070

laboratory which is an unprecedented

426

00:19:08,400 --> 00:19:06,460

tool for a biological which is in

427

00:19:10,410 --> 00:19:08,410

general for scientific research but in

428

00:19:14,100 --> 00:19:10,420

particular for biological and more

429

00:19:16,770 --> 00:19:14,110

particularly for plant research gravity

430

00:19:19,410 --> 00:19:16,780

is an essential factor for the for the

431

00:19:22,110 --> 00:19:19,420

growth of plants roots growth on walls

432

00:19:24,510 --> 00:19:22,120

and stem grow upwards because of the

433

00:19:27,390 --> 00:19:24,520

presence of the gravity vector when this

434

00:19:30,660 --> 00:19:27,400

vector is absent as in space this

435

00:19:33,150 --> 00:19:30,670

process is totally disorganized and the

436

00:19:35,580 --> 00:19:33,160

study of the particular cellular and

437

00:19:38,280 --> 00:19:35,590

molecular mechanisms of this process is

438

00:19:40,410 --> 00:19:38,290

essential to be capable of successfully

439

00:19:42,570 --> 00:19:40,420

growing plants in the future in the

440

00:19:45,630 --> 00:19:42,580

conditions of microgravity that exist in

441

00:19:47,580 --> 00:19:45,640

space European scientists have developed

442

00:19:48,990 --> 00:19:47,590

a fundamental role in the discrimination

443

00:19:52,260 --> 00:19:49,000

of these cellular and molecular

444

00:19:54,510 --> 00:19:52,270

mechanisms then the next step is to pass

445

00:19:56,580 --> 00:19:54,520

from the model plant that we are now

446

00:19:59,159 --> 00:19:56,590

using olavide OPS's is a plant that

447

00:20:01,330 --> 00:19:59,169

nobody is interested in except plant

448

00:20:03,970 --> 00:20:01,340

scientists because it's the model

449

00:20:06,700 --> 00:20:03,980

so to bust through through a branch of

450

00:20:10,170 --> 00:20:06,710

economical value such as rice or wheat

451
00:20:12,820 --> 00:20:10,180
or cereals in general so you are being

452
00:20:15,190 --> 00:20:12,830
plants which are interesting for human

453
00:20:18,760 --> 00:20:15,200
food and then the next step is to

454
00:20:21,760 --> 00:20:18,770
produce a space garden or a special

455
00:20:24,690 --> 00:20:21,770
space culture capable of producing a

456
00:20:27,880 --> 00:20:24,700
crop capable of being eaten or being

457
00:20:30,430 --> 00:20:27,890
taken by astronauts as they food and

458
00:20:34,090 --> 00:20:30,440
also an interesting factor as a

459
00:20:37,840 --> 00:20:34,100
psychological relief and we will be

460
00:20:41,110 --> 00:20:37,850
capable of producing plants that will be

461
00:20:44,200 --> 00:20:41,120
able of growing deeper in the soil or on

462
00:20:47,470 --> 00:20:44,210
the contrary which the roots growing

463
00:20:50,260 --> 00:20:47,480

more recently and this is very important

464

00:20:53,620 --> 00:20:50,270

in terms of the the capability of taking

465

00:20:57,490 --> 00:20:53,630

the water which is being found deeper or

466

00:20:59,470 --> 00:20:57,500

at the surface of the soil so really the

467

00:21:01,720 --> 00:20:59,480

purpose the objective is really to

468

00:21:04,540 --> 00:21:01,730

translate and to translate this the

469

00:21:06,910 --> 00:21:04,550

earth garden to Mars or to the moon or

470

00:21:10,540 --> 00:21:06,920

to the interior of the space station or

471

00:21:14,320 --> 00:21:10,550

whatever space vehicle or whatever space

472

00:21:19,210 --> 00:21:14,330

planet or space habitat that the human

473

00:21:20,650 --> 00:21:19,220

being can put the feet on we also just

474

00:21:23,150 --> 00:21:20,660

get my big cutter on the other side of

475

00:21:26,150 --> 00:21:23,160

my ID thank you

476
00:21:31,790 --> 00:21:26,160
got me there are you loving three but

477
00:21:34,580 --> 00:21:31,800
I'm a fool dancing absolutely it's just

478
00:21:48,560 --> 00:21:34,590
like in the pool instead of that the

479
00:21:51,400 --> 00:21:48,570
exception of a big booth as the

480
00:21:54,160 --> 00:21:51,410
International Space Station flies 257

481
00:21:56,960 --> 00:21:54,170
statute miles over the coast of Chile

482
00:22:01,390 --> 00:21:56,970
terry virts and the initial moments of

483
00:22:07,160 --> 00:22:05,090
all right let's recap this episode today

484
00:22:08,920 --> 00:22:07,170
we talked about breakthroughs in

485
00:22:11,090 --> 00:22:08,930
Duchenne muscular dystrophy

486
00:22:13,910 --> 00:22:11,100
understanding how Alzheimer's disease

487
00:22:15,850 --> 00:22:13,920
develops amazing biological research

488
00:22:18,580 --> 00:22:15,860

possibilities on the ISS and

489

00:22:20,480 --> 00:22:18,590

understanding how plants grow in space

490

00:22:22,820 --> 00:22:20,490

look like we've been hard at work

491

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

studying life off the earth to help

492

00:22:28,190 --> 00:22:25,800

improve life right here on earth and if

493

00:22:29,930 --> 00:22:28,200

that ain't life I don't know what is so

494

00:22:31,340 --> 00:22:29,940

be sure to stay in touch and follow us

495

00:22:33,770 --> 00:22:31,350

on Facebook and Twitter for the latest

496

00:22:35,390 --> 00:22:33,780

research news and don't forget to

497

00:22:38,390 --> 00:22:35,400

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