



1  
00:00:05,110 --> 00:00:03,429  
so with the third annual international

2  
00:00:06,710 --> 00:00:05,120  
space station research and development

3  
00:00:08,310 --> 00:00:06,720  
conference four awards were given out

4  
00:00:11,509 --> 00:00:08,320  
for the most compelling international

5  
00:00:13,110 --> 00:00:11,519  
space station science projects of 2013.

6  
00:00:14,709 --> 00:00:13,120  
here to tell us more is the chief

7  
00:00:16,070 --> 00:00:14,719  
program scientist for nasa's

8  
00:00:17,830 --> 00:00:16,080  
international space station program

9  
00:00:19,750 --> 00:00:17,840  
julie robinson now the first one i want

10  
00:00:22,150 --> 00:00:19,760  
to talk about went to carl carruthers of

11  
00:00:23,990 --> 00:00:22,160  
nanoracks llc for his work and

12  
00:00:26,310 --> 00:00:24,000  
nanorack's work on protein crystal

13  
00:00:28,070 --> 00:00:26,320

growth start off protein crystals

14

00:00:30,470 --> 00:00:28,080

huge huge

15

00:00:32,229 --> 00:00:30,480

experiment for microgravity research on

16

00:00:34,310 --> 00:00:32,239

the station first off give us a little

17

00:00:35,750 --> 00:00:34,320

more background about why those are such

18

00:00:37,910 --> 00:00:35,760

a big deal

19

00:00:40,069 --> 00:00:37,920

so people are interested in growing

20

00:00:41,910 --> 00:00:40,079

crystals on the space station because

21

00:00:45,270 --> 00:00:41,920

those crystals without having

22

00:00:47,270 --> 00:00:45,280

sedimentation and convection flow

23

00:00:48,950 --> 00:00:47,280

moving through the system they

24

00:00:51,029 --> 00:00:48,960

crystallize more slowly and there's time

25

00:00:53,110 --> 00:00:51,039

for all the molecules to line up and get

26  
00:00:54,389 --> 00:00:53,120  
a more perfectly structured crystal now

27  
00:00:55,910 --> 00:00:54,399  
of course that depends on if you get the

28  
00:00:59,029 --> 00:00:55,920  
conditions right

29  
00:01:01,830 --> 00:00:59,039  
and that's what is so innovative about

30  
00:01:04,149 --> 00:01:01,840  
carruther's work with nanoracks so what

31  
00:01:07,270 --> 00:01:04,159  
nanoracks did they are a commercial

32  
00:01:09,910 --> 00:01:07,280  
company they are using or facilitating

33  
00:01:11,990 --> 00:01:09,920  
researchers to use the iss

34  
00:01:13,670 --> 00:01:12,000  
hundreds of researchers they worked with

35  
00:01:16,390 --> 00:01:13,680  
and what they did is they worked with

36  
00:01:17,749 --> 00:01:16,400  
carruthers to develop

37  
00:01:20,390 --> 00:01:17,759  
some something we sometimes call a

38  
00:01:22,390 --> 00:01:20,400

crystal hotel it's a on the ground piece

39

00:01:24,469 --> 00:01:22,400

of software that they adapted for use in

40

00:01:26,950 --> 00:01:24,479

space flight in this nanorack system so

41

00:01:29,749 --> 00:01:26,960

it's very low cost and the thing that's

42

00:01:31,510 --> 00:01:29,759

great about it is it supports

43

00:01:33,270 --> 00:01:31,520

thousands of different experiment

44

00:01:34,870 --> 00:01:33,280

conditions all at the same time so

45

00:01:37,030 --> 00:01:34,880

instead of trying to get it perfectly

46

00:01:38,469 --> 00:01:37,040

right on earth you can screen with a lot

47

00:01:40,789 --> 00:01:38,479

of different conditions and run

48

00:01:42,230 --> 00:01:40,799

thousands of samples and get a good

49

00:01:43,990 --> 00:01:42,240

quality crystal and what carruthers

50

00:01:46,630 --> 00:01:44,000

showed is from the very first flight of

51  
00:01:48,710 --> 00:01:46,640  
this new crystal system that he got good

52  
00:01:50,149 --> 00:01:48,720  
research results okay and what are some

53  
00:01:51,990 --> 00:01:50,159  
of the benefits that some of the

54  
00:01:54,469 --> 00:01:52,000  
experiments taking advantage of this new

55  
00:01:55,590 --> 00:01:54,479  
system could potentially lead to so

56  
00:01:57,270 --> 00:01:55,600  
there are

57  
00:01:59,350 --> 00:01:57,280  
thousands of proteins in the world where

58  
00:02:02,310 --> 00:01:59,360  
we've identified that that protein is

59  
00:02:04,630 --> 00:02:02,320  
important in a disease of some sort but

60  
00:02:06,950 --> 00:02:04,640  
we don't know what the protein looks

61  
00:02:09,190 --> 00:02:06,960  
like structurally if you know the shape

62  
00:02:11,670 --> 00:02:09,200  
of the protein you might be able to

63  
00:02:13,670 --> 00:02:11,680

design a drug to interfere with it or

64

00:02:15,670 --> 00:02:13,680

assist it or do something else if you

65

00:02:17,510 --> 00:02:15,680

know that protein matters you've got to

66

00:02:19,750 --> 00:02:17,520

have the shape or that structure and so

67

00:02:22,710 --> 00:02:19,760

in getting a good crystal then you can

68

00:02:24,710 --> 00:02:22,720

use either x-ray crystallography or

69

00:02:26,869 --> 00:02:24,720

other kinds of neutron techniques to get

70

00:02:29,670 --> 00:02:26,879

the structure of the protein there's a

71

00:02:31,589 --> 00:02:29,680

center for biomolecular structure at the

72

00:02:33,670 --> 00:02:31,599

national institutes of health that has a

73

00:02:35,589 --> 00:02:33,680

list of all the desirable proteins that

74

00:02:38,470 --> 00:02:35,599

we don't have structures for yet

75

00:02:39,990 --> 00:02:38,480

and then also pharmaceutical companies

76  
00:02:41,509 --> 00:02:40,000  
many of whom are working on different

77  
00:02:43,270 --> 00:02:41,519  
drug development pathways will have

78  
00:02:45,350 --> 00:02:43,280  
certain molecules that they want to

79  
00:02:47,350 --> 00:02:45,360  
understand and so this nanoracks

80  
00:02:49,030 --> 00:02:47,360  
innovation provides the opportunity for

81  
00:02:50,790 --> 00:02:49,040  
companies like that to very quickly try

82  
00:02:52,550 --> 00:02:50,800  
something on the space station and see

83  
00:02:54,550 --> 00:02:52,560  
if that would be an opportunity for them

84  
00:02:56,710 --> 00:02:54,560  
to make an advance was there any other

85  
00:02:59,030 --> 00:02:56,720  
aspect of nanorack's

86  
00:03:01,190 --> 00:02:59,040  
new initiative that led you guys to give

87  
00:03:02,949 --> 00:03:01,200  
them this award

88  
00:03:04,790 --> 00:03:02,959

you know what we were excited about was

89

00:03:06,550 --> 00:03:04,800

just the cost effectiveness and the

90

00:03:09,750 --> 00:03:06,560

number of samples that you could get and

91

00:03:11,190 --> 00:03:09,760

the fact that they proved that that

92

00:03:13,030 --> 00:03:11,200

a number of those crystals really were

93

00:03:15,110 --> 00:03:13,040

of very good quality so it's an

94

00:03:16,550 --> 00:03:15,120

encouraging technological improvement

95

00:03:18,390 --> 00:03:16,560

there are other

96

00:03:20,630 --> 00:03:18,400

protein crystal growth studies flying

97

00:03:22,470 --> 00:03:20,640

this year that will also help us to

98

00:03:24,149 --> 00:03:22,480

finally answer that question can you

99

00:03:25,350 --> 00:03:24,159

really get better proteins in space and

100

00:03:27,910 --> 00:03:25,360

so we'll be looking that pretty

101  
00:03:29,990 --> 00:03:27,920  
comprehensively and then let's move on

102  
00:03:32,630 --> 00:03:30,000  
to our next one and this award went to

103  
00:03:34,869 --> 00:03:32,640  
nabaroon chakraborty with the u.s army

104  
00:03:37,190 --> 00:03:34,879  
center for environmental health research

105  
00:03:39,110 --> 00:03:37,200  
and it was his award was for research

106  
00:03:41,430 --> 00:03:39,120  
being done into how microgravity affects

107  
00:03:43,030 --> 00:03:41,440  
host immune systems now first off again

108  
00:03:44,789 --> 00:03:43,040  
give me a little bit more background on

109  
00:03:46,470 --> 00:03:44,799  
this project and what led you guys to

110  
00:03:49,030 --> 00:03:46,480  
get this award and why it was so

111  
00:03:51,350 --> 00:03:49,040  
compelling yeah so dr

112  
00:03:53,670 --> 00:03:51,360  
chakraborty's research over the years

113  
00:03:55,429 --> 00:03:53,680

has used space flight several times and

114

00:03:57,830 --> 00:03:55,439

it's really been focused on

115

00:04:00,070 --> 00:03:57,840

understanding the processes of wound

116

00:04:01,990 --> 00:04:00,080

healing at the cellular level you know

117

00:04:03,990 --> 00:04:02,000

when you have a cut in your skin those

118

00:04:05,670 --> 00:04:04,000

epidermal cells they have to have their

119

00:04:07,429 --> 00:04:05,680

stem cells there that have to make new

120

00:04:09,110 --> 00:04:07,439

skin to cover it back over and that's

121

00:04:10,869 --> 00:04:09,120

what wound healing is

122

00:04:12,630 --> 00:04:10,879

and um

123

00:04:14,470 --> 00:04:12,640

i you know it's it's a very important

124

00:04:15,910 --> 00:04:14,480

process we kind of take it for granted

125

00:04:17,509 --> 00:04:15,920

you know you cut yourself and you put a

126

00:04:19,749 --> 00:04:17,519

band-aid on it and then it's magically

127

00:04:22,150 --> 00:04:19,759

better in a couple weeks i learned

128

00:04:24,150 --> 00:04:22,160

recently in a personal level why not to

129

00:04:25,830 --> 00:04:24,160

take that for granted because

130

00:04:27,510 --> 00:04:25,840

we have a i have a family member that

131

00:04:29,590 --> 00:04:27,520

has diabetes and one of the things that

132

00:04:32,310 --> 00:04:29,600

happens in diabetics sometimes is they

133

00:04:35,030 --> 00:04:32,320

get poor circulation in their feet and

134

00:04:37,110 --> 00:04:35,040

then wounds don't heal and so she got a

135

00:04:38,870 --> 00:04:37,120

cut on her foot that couldn't heal and

136

00:04:40,310 --> 00:04:38,880

couldn't heal and she had to get special

137

00:04:41,110 --> 00:04:40,320

medical attention and all of those

138

00:04:41,990 --> 00:04:41,120

things

139

00:04:43,830 --> 00:04:42,000

so

140

00:04:45,909 --> 00:04:43,840

one of the in understanding what are the

141

00:04:48,310 --> 00:04:45,919

factors that turn on these stem cells

142

00:04:49,990 --> 00:04:48,320

that lead to that interaction how is the

143

00:04:51,670 --> 00:04:50,000

immune system part of that right because

144

00:04:53,030 --> 00:04:51,680

the immune system is going there sending

145

00:04:55,030 --> 00:04:53,040

white blood cells to make sure the

146

00:04:56,550 --> 00:04:55,040

infection doesn't occur how does that

147

00:04:58,550 --> 00:04:56,560

whole system in the body work and that

148

00:05:00,150 --> 00:04:58,560

was the subject of dr chakraborty's

149

00:05:02,230 --> 00:05:00,160

research okay and i know that there are

150

00:05:04,870 --> 00:05:02,240

some challenges doing similar research

151  
00:05:07,350 --> 00:05:04,880  
here down on the earth in the presence

152  
00:05:09,430 --> 00:05:07,360  
of gravity why is the work being done in

153  
00:05:11,909 --> 00:05:09,440  
orbit in microgravity on the station of

154  
00:05:13,590 --> 00:05:11,919  
particular importance yeah so it's

155  
00:05:15,670 --> 00:05:13,600  
interesting that microgravity might be a

156  
00:05:17,510 --> 00:05:15,680  
good model for wound healing what's been

157  
00:05:19,510 --> 00:05:17,520  
found so far is that wound healing seems

158  
00:05:21,670 --> 00:05:19,520  
to be slowed in microgravity and so you

159  
00:05:23,990 --> 00:05:21,680  
can use that to then see

160  
00:05:26,629 --> 00:05:24,000  
if you can pump up the process speed it

161  
00:05:28,070 --> 00:05:26,639  
up even in a cell culture if you have if

162  
00:05:30,150 --> 00:05:28,080  
you know what you would expect that

163  
00:05:32,550 --> 00:05:30,160

culture to do on earth and you can make

164

00:05:34,070 --> 00:05:32,560

it perform wound healing like functions

165

00:05:35,029 --> 00:05:34,080

more quickly in space that's a good

166

00:05:36,870 --> 00:05:35,039

model

167

00:05:38,629 --> 00:05:36,880

okay and what's some of the work that

168

00:05:41,510 --> 00:05:38,639

might be coming out in the future as a

169

00:05:43,430 --> 00:05:41,520

result of dr chakraborty's research

170

00:05:45,749 --> 00:05:43,440

experiment uh well there is future

171

00:05:48,070 --> 00:05:45,759

research that we're expecting that is

172

00:05:49,749 --> 00:05:48,080

using more complex model organisms to

173

00:05:51,430 --> 00:05:49,759

understand wound healing better we also

174

00:05:52,469 --> 00:05:51,440

expect to see more cell biology studies

175

00:05:54,790 --> 00:05:52,479

in the future

176

00:05:56,150 --> 00:05:54,800

now we're going to move on to another

177

00:05:58,469 --> 00:05:56,160

research study that was looking at the

178

00:06:00,550 --> 00:05:58,479

human body and how it works in space it

179

00:06:02,150 --> 00:06:00,560

was worked on integrated cardiovascular

180

00:06:03,350 --> 00:06:02,160

so again real quick give us a quick

181

00:06:05,990 --> 00:06:03,360

background on what integrated

182

00:06:08,150 --> 00:06:06,000

cardiovascular or icv is that pretty

183

00:06:09,590 --> 00:06:08,160

large team did almost three years of

184

00:06:11,430 --> 00:06:09,600

research on the international space

185

00:06:13,029 --> 00:06:11,440

station looking at the function of the

186

00:06:15,830 --> 00:06:13,039

human heart

187

00:06:17,189 --> 00:06:15,840

we know that just based on the fitness

188

00:06:18,550 --> 00:06:17,199

levels of astronauts we knew their

189

00:06:20,469 --> 00:06:18,560

hearts were changing when they went into

190

00:06:23,350 --> 00:06:20,479

space but this was the first time we'd

191

00:06:25,590 --> 00:06:23,360

really looked at both the physical shape

192

00:06:27,590 --> 00:06:25,600

and structure of the heart as well as at

193

00:06:29,430 --> 00:06:27,600

its performance the other thing we knew

194

00:06:32,150 --> 00:06:29,440

before this study began is we knew there

195

00:06:34,390 --> 00:06:32,160

had been a couple observations of kind

196

00:06:36,870 --> 00:06:34,400

of scary arrhythmias and so we were

197

00:06:38,070 --> 00:06:36,880

concerned that if that was normal if

198

00:06:39,350 --> 00:06:38,080

that was something that happened to a

199

00:06:41,110 --> 00:06:39,360

lot of astronauts that could be a

200

00:06:44,309 --> 00:06:41,120

significant risk for spaceflight or

201  
00:06:46,230 --> 00:06:44,319  
significant risk for spacewalks as well

202  
00:06:47,350 --> 00:06:46,240  
and we didn't have the kinds of

203  
00:06:49,270 --> 00:06:47,360  
arrhythmias we needed pretty

204  
00:06:50,710 --> 00:06:49,280  
sophisticated halter monitors to get

205  
00:06:52,950 --> 00:06:50,720  
those measurements so all of that was

206  
00:06:54,629 --> 00:06:52,960  
wrapped up together in a study called

207  
00:06:56,390 --> 00:06:54,639  
integrated cardiovascular now you see

208  
00:06:58,390 --> 00:06:56,400  
why it's integrated

209  
00:07:00,150 --> 00:06:58,400  
and it took about

210  
00:07:02,390 --> 00:07:00,160  
there were 13 subjects

211  
00:07:04,629 --> 00:07:02,400  
on the iss that took over two years to

212  
00:07:06,150 --> 00:07:04,639  
get all of those subjects accumulated

213  
00:07:07,749 --> 00:07:06,160

together and the results are just

214

00:07:09,110 --> 00:07:07,759

starting now to come out and they were

215

00:07:11,749 --> 00:07:09,120

really exciting and so that's why this

216

00:07:13,270 --> 00:07:11,759

team was selected for the award okay and

217

00:07:15,029 --> 00:07:13,280

what are some of those exciting results

218

00:07:17,029 --> 00:07:15,039

we're seeing i know we've learned a lot

219

00:07:18,629 --> 00:07:17,039

more about the mechanism of the heart

220

00:07:19,909 --> 00:07:18,639

atrophying or kind of weakening in

221

00:07:21,909 --> 00:07:19,919

microgravity what are some of the

222

00:07:23,909 --> 00:07:21,919

results that we found yeah so one of the

223

00:07:25,510 --> 00:07:23,919

things that that the investigators saw

224

00:07:27,189 --> 00:07:25,520

is of course the heart got smaller

225

00:07:28,950 --> 00:07:27,199

because it wasn't working very hard you

226

00:07:30,870 --> 00:07:28,960

know on earth your heart really has to

227

00:07:32,070 --> 00:07:30,880

work to pump that blood out of your legs

228

00:07:34,230 --> 00:07:32,080

and keep it up in your head where your

229

00:07:36,070 --> 00:07:34,240

brain gets it in space everything's

230

00:07:37,510 --> 00:07:36,080

floating around kind of equally and so

231

00:07:39,749 --> 00:07:37,520

it's that's not such a problem and so

232

00:07:41,909 --> 00:07:39,759

that wasn't a surprising result i was a

233

00:07:44,390 --> 00:07:41,919

little more surprised to hear that the

234

00:07:46,390 --> 00:07:44,400

heart becomes more spherically shaped as

235

00:07:47,909 --> 00:07:46,400

it shrinks so this

236

00:07:50,550 --> 00:07:47,919

and even the investigators even showed a

237

00:07:52,550 --> 00:07:50,560

picture of the grinch um in in their

238

00:07:55,270 --> 00:07:52,560

charts because it kind of helps capture

239

00:07:57,589 --> 00:07:55,280

that it's smaller more and more round as

240

00:07:58,790 --> 00:07:57,599

what the structural changes are but they

241

00:08:01,350 --> 00:07:58,800

also found when the crew members

242

00:08:03,510 --> 00:08:01,360

returned to earth it responded very

243

00:08:05,909 --> 00:08:03,520

rapidly at rebuilding that mass when it

244

00:08:07,749 --> 00:08:05,919

was necessary so this was this is

245

00:08:10,150 --> 00:08:07,759

healthy when you think about it a muscle

246

00:08:11,589 --> 00:08:10,160

that's not used gets smaller get

247

00:08:13,110 --> 00:08:11,599

atrophies a little bit when you start

248

00:08:15,189 --> 00:08:13,120

using that muscle again you get back in

249

00:08:17,589 --> 00:08:15,199

shape and it grows again and so so that

250

00:08:19,589 --> 00:08:17,599

really was quite comforting that um when

251  
00:08:21,350 --> 00:08:19,599  
a crew member say gets done with a mars

252  
00:08:22,629 --> 00:08:21,360  
transit their heart may have shrunk a

253  
00:08:25,029 --> 00:08:22,639  
little bit but when they start doing

254  
00:08:27,029 --> 00:08:25,039  
more rigorous uh spacewalks out on the

255  
00:08:28,390 --> 00:08:27,039  
mars surface in a 300 pound pack their

256  
00:08:30,150 --> 00:08:28,400  
heart's going to respond to that just

257  
00:08:31,909 --> 00:08:30,160  
give them a few days to train into it

258  
00:08:33,430 --> 00:08:31,919  
don't make them do it all the first day

259  
00:08:35,190 --> 00:08:33,440  
and and their heart will recover as a

260  
00:08:37,110 --> 00:08:35,200  
good muscle

261  
00:08:39,509 --> 00:08:37,120  
the other thing that was really

262  
00:08:40,709 --> 00:08:39,519  
important from the study was the data on

263  
00:08:43,750 --> 00:08:40,719

arrhythmias

264

00:08:45,670 --> 00:08:43,760

and uh what what they found was that if

265

00:08:47,910 --> 00:08:45,680

crew members tended to skip a beat here

266

00:08:49,829 --> 00:08:47,920

or there on earth they tended to skip a

267

00:08:51,350 --> 00:08:49,839

beat here or there in space so there

268

00:08:53,190 --> 00:08:51,360

wasn't a huge difference there wasn't a

269

00:08:55,269 --> 00:08:53,200

difference and so that makes us really

270

00:08:56,230 --> 00:08:55,279

comfortable because that lets us know

271

00:08:58,070 --> 00:08:56,240

that

272

00:08:59,509 --> 00:08:58,080

whatever we're seeing in the regular

273

00:09:01,110 --> 00:08:59,519

health monitoring of crew members on

274

00:09:03,430 --> 00:09:01,120

earth is what it's going to be

275

00:09:05,509 --> 00:09:03,440

the thing that surprised me most

276

00:09:07,269 --> 00:09:05,519

in the charts that that

277

00:09:08,550 --> 00:09:07,279

that were presented were some examples

278

00:09:09,750 --> 00:09:08,560

of the benefits back here on earth

279

00:09:11,670 --> 00:09:09,760

because this was a study that was

280

00:09:13,190 --> 00:09:11,680

selected completely for exploration

281

00:09:13,910 --> 00:09:13,200

purposes

282

00:09:16,389 --> 00:09:13,920

but

283

00:09:18,310 --> 00:09:16,399

the data that they got

284

00:09:20,230 --> 00:09:18,320

is they applied then to a set of

285

00:09:22,230 --> 00:09:20,240

patients who have a really rare

286

00:09:24,310 --> 00:09:22,240

abnormality these are patients who have

287

00:09:26,070 --> 00:09:24,320

been

288

00:09:27,829 --> 00:09:26,080

star athletes really significant

289

00:09:29,829 --> 00:09:27,839

athletes they showed examples of ballet

290

00:09:31,509 --> 00:09:29,839

dancers marathon runners people who have

291

00:09:33,750 --> 00:09:31,519

been trained up to a really high level

292

00:09:36,070 --> 00:09:33,760

of fitness and occasionally when those

293

00:09:38,230 --> 00:09:36,080

people retire from their sport their

294

00:09:40,150 --> 00:09:38,240

heart atrophy significantly gets really

295

00:09:42,389 --> 00:09:40,160

really small and they become almost

296

00:09:43,269 --> 00:09:42,399

debilitated unable to

297

00:09:45,990 --> 00:09:43,279

walk

298

00:09:49,829 --> 00:09:46,000

sit up he gave an example of a ballet

299

00:09:51,829 --> 00:09:49,839

dancer who after she stopped dancing was

300

00:09:53,350 --> 00:09:51,839

bound to a wheelchair couldn't even sit

301  
00:09:54,790 --> 00:09:53,360  
up without passing out and getting

302  
00:09:56,870 --> 00:09:54,800  
really dizzy and things like that

303  
00:09:59,110 --> 00:09:56,880  
because her heart it's like it

304  
00:10:00,630 --> 00:09:59,120  
undercompensated overcompensated on shrinking

305  
00:10:02,790 --> 00:10:00,640  
down or something like that and not

306  
00:10:05,350 --> 00:10:02,800  
having those rigorous activities it's

307  
00:10:06,630 --> 00:10:05,360  
incredibly rare but but he said you know

308  
00:10:08,230 --> 00:10:06,640  
there are numerous patients around the

309  
00:10:10,069 --> 00:10:08,240  
country that are suffering from that and

310  
00:10:12,310 --> 00:10:10,079  
what they were able to do was use the

311  
00:10:13,829 --> 00:10:12,320  
model that they built for the astronauts

312  
00:10:16,389 --> 00:10:13,839  
heart recovery

313  
00:10:17,670 --> 00:10:16,399

and realized that the exercise

314

00:10:19,590 --> 00:10:17,680

techniques that we're using to help

315

00:10:21,030 --> 00:10:19,600

astronauts recover and grow their heart

316

00:10:23,110 --> 00:10:21,040

volume back up might work for these

317

00:10:24,790 --> 00:10:23,120

patients and they had great success all

318

00:10:27,350 --> 00:10:24,800

right well let's move on to our last one

319

00:10:29,030 --> 00:10:27,360

our fourth compelling science result and

320

00:10:31,750 --> 00:10:29,040

this went to matthew lynch procter

321

00:10:33,670 --> 00:10:31,760

gamble and this my personal favorite as

322

00:10:37,030 --> 00:10:33,680

always colloids advanced colloids

323

00:10:39,190 --> 00:10:37,040

experiment which has a huge huge impact

324

00:10:41,910 --> 00:10:39,200

on consumer products right now first off

325

00:10:43,590 --> 00:10:41,920

what are colloids and how

326

00:10:45,269 --> 00:10:43,600

how do they have such a huge impact in

327

00:10:47,750 --> 00:10:45,279

you know everyday household products

328

00:10:49,910 --> 00:10:47,760

yeah so colloids sound high tech but

329

00:10:52,710 --> 00:10:49,920

what they really are is any kind of a

330

00:10:55,430 --> 00:10:52,720

solid mixed in a liquid matrix and so we

331

00:10:57,509 --> 00:10:55,440

use them constantly

332

00:10:59,590 --> 00:10:57,519

detergents paints

333

00:11:01,990 --> 00:10:59,600

fabric softener

334

00:11:03,750 --> 00:11:02,000

liquid medicines are often

335

00:11:05,750 --> 00:11:03,760

a colloid where you've got some kind of

336

00:11:07,910 --> 00:11:05,760

maybe a gel substance mixed in a liquid

337

00:11:09,350 --> 00:11:07,920

matrix and so they're all over in our

338

00:11:11,509 --> 00:11:09,360

lives in fact

339

00:11:13,110 --> 00:11:11,519

procter gamble

340

00:11:15,509 --> 00:11:13,120

which is the company that has partnered

341

00:11:17,509 --> 00:11:15,519

with nasa in this particular research

342

00:11:20,310 --> 00:11:17,519

they have estimated that five million

343

00:11:22,790 --> 00:11:20,320

people touch their products every day or

344

00:11:24,870 --> 00:11:22,800

sorry five billion people so

345

00:11:27,110 --> 00:11:24,880

almost half the world touch their

346

00:11:28,949 --> 00:11:27,120

products some in some way every day some

347

00:11:30,069 --> 00:11:28,959

kind of product now i'm trying to get my

348

00:11:31,990 --> 00:11:30,079

head around that because that seems like

349

00:11:33,670 --> 00:11:32,000

a big number but that's what their

350

00:11:35,350 --> 00:11:33,680

marketing you know their marketing

351  
00:11:37,190 --> 00:11:35,360  
estimates are and when you think about

352  
00:11:38,870 --> 00:11:37,200  
how ubiquitous all the different

353  
00:11:39,910 --> 00:11:38,880  
products you know how many people wash

354  
00:11:41,590 --> 00:11:39,920  
clothes

355  
00:11:42,470 --> 00:11:41,600  
in the world every day and how many

356  
00:11:44,150 --> 00:11:42,480  
people

357  
00:11:47,190 --> 00:11:44,160  
do those different kinds of things so

358  
00:11:49,110 --> 00:11:47,200  
it's it's possible and so what dr lynch

359  
00:11:51,269 --> 00:11:49,120  
who's a research scientist with procter

360  
00:11:53,190 --> 00:11:51,279  
gamble has been doing for a number of

361  
00:11:55,990 --> 00:11:53,200  
years on the space station

362  
00:11:58,230 --> 00:11:56,000  
is using the space as a model for

363  
00:12:00,470 --> 00:11:58,240

colloid separation and the reason he can

364

00:12:02,150 --> 00:12:00,480

study things there and not on the ground

365

00:12:03,829 --> 00:12:02,160

is because the colloids don't separate

366

00:12:05,509 --> 00:12:03,839

out and so you can get really simple

367

00:12:06,870 --> 00:12:05,519

mathematics that you can't do on the

368

00:12:08,550 --> 00:12:06,880

ground once you understand that

369

00:12:10,550 --> 00:12:08,560

mathematics you can put things back on

370

00:12:12,150 --> 00:12:10,560

the ground and model better ways to keep

371

00:12:14,310 --> 00:12:12,160

those colloids mixed

372

00:12:16,550 --> 00:12:14,320

and you know it's nice to have your

373

00:12:17,750 --> 00:12:16,560

say your fabric softener not separate

374

00:12:19,110 --> 00:12:17,760

so that when you put in your clothes you

375

00:12:20,629 --> 00:12:19,120

get the right amount but it could be

376

00:12:23,269 --> 00:12:20,639

critical even though this isn't a

377

00:12:25,590 --> 00:12:23,279

procter gamble product the application

378

00:12:27,350 --> 00:12:25,600

to something like a cough medicine where

379

00:12:30,389 --> 00:12:27,360

getting the wrong dose could really be

380

00:12:32,470 --> 00:12:30,399

harmful is important and so it's it's

381

00:12:34,470 --> 00:12:32,480

exciting to see that work you know this

382

00:12:36,069 --> 00:12:34,480

fundamental physical measurements of

383

00:12:38,310 --> 00:12:36,079

things modeling of things actually have

384

00:12:39,670 --> 00:12:38,320

these applications in our daily lives

385

00:12:41,110 --> 00:12:39,680

and just

386

00:12:42,629 --> 00:12:41,120

real quick just some of the knowledge

387

00:12:44,790 --> 00:12:42,639

that we've gained from this and is it

388

00:12:46,470 --> 00:12:44,800

already being implemented you say we're

389

00:12:48,870 --> 00:12:46,480

finding these things out on such a small

390

00:12:51,350 --> 00:12:48,880

level what besides just shelf life will

391

00:12:53,110 --> 00:12:51,360

this have an impact so dr lynch reported

392

00:12:55,670 --> 00:12:53,120

it has already affected the formulation

393

00:12:56,790 --> 00:12:55,680

of a number of different products um the

394

00:12:58,470 --> 00:12:56,800

work that they've done on the space

395

00:13:00,389 --> 00:12:58,480

station to date and that he's

396

00:13:01,430 --> 00:13:00,399

anticipating some of his new results

397

00:13:03,030 --> 00:13:01,440

will be

398

00:13:05,590 --> 00:13:03,040

in consumer products in the very near

399

00:13:07,110 --> 00:13:05,600

future so julie aside from these four

400

00:13:09,430 --> 00:13:07,120

compelling research awards that got

401  
00:13:11,509 --> 00:13:09,440  
handed out at the rd conference sam

402  
00:13:13,670 --> 00:13:11,519  
ting who does all the work with the

403  
00:13:15,750 --> 00:13:13,680  
alpha magnetic spectrometer gave a

404  
00:13:17,590 --> 00:13:15,760  
presentation and you found that

405  
00:13:19,350 --> 00:13:17,600  
particularly compelling also why don't

406  
00:13:21,110 --> 00:13:19,360  
you tell us a little bit about what what

407  
00:13:23,030 --> 00:13:21,120  
happens whenever a nobel prize winner

408  
00:13:23,750 --> 00:13:23,040  
comes and presents at a conference it's

409  
00:13:26,230 --> 00:13:23,760  
it's

410  
00:13:27,910 --> 00:13:26,240  
usually by definition a big deal

411  
00:13:30,629 --> 00:13:27,920  
and of course dr ting has been doing

412  
00:13:33,509 --> 00:13:30,639  
research on the space station since 2011

413  
00:13:35,670 --> 00:13:33,519

on the alpha magnetic spectrometer it's

414

00:13:38,710 --> 00:13:35,680

essentially a giant magnet and particle

415

00:13:40,550 --> 00:13:38,720

detector and it's measuring galactic

416

00:13:42,790 --> 00:13:40,560

cosmic rays those are radioactive

417

00:13:44,790 --> 00:13:42,800

particles essentially that have come all

418

00:13:46,470 --> 00:13:44,800

the way back from the big bang and they

419

00:13:49,269 --> 00:13:46,480

arrive and they're registered on this

420

00:13:50,949 --> 00:13:49,279

detector he can measure the energy the

421

00:13:52,389 --> 00:13:50,959

mass of the particle in the direction

422

00:13:54,949 --> 00:13:52,399

it's coming from

423

00:13:57,350 --> 00:13:54,959

so far they've collected over 50 billion

424

00:13:59,590 --> 00:13:57,360

observations of galactic cosmic rays

425

00:14:00,710 --> 00:13:59,600

each one of them a data point with that

426

00:14:03,030 --> 00:14:00,720

information

427

00:14:05,110 --> 00:14:03,040

and what that's allowing is that's

428

00:14:07,590 --> 00:14:05,120

allowing more and more data to

429

00:14:09,750 --> 00:14:07,600

accumulate on the rare particles

430

00:14:12,949 --> 00:14:09,760

so what he presented last week in

431

00:14:15,590 --> 00:14:12,959

chicago was the first

432

00:14:17,509 --> 00:14:15,600

data he's ever shared in the higher

433

00:14:19,590 --> 00:14:17,519

energy range than has ever been measured

434

00:14:22,230 --> 00:14:19,600

by any other instruments in the past he

435

00:14:25,110 --> 00:14:22,240

had had presented data up to

436

00:14:28,069 --> 00:14:25,120

300 giga electron volts and last week he

437

00:14:29,670 --> 00:14:28,079

showed us data points up to 500 giga

438

00:14:31,750 --> 00:14:29,680

electron volts and so what's the

439

00:14:33,990 --> 00:14:31,760

significance when we start getting into

440

00:14:37,030 --> 00:14:34,000

these higher energy levels so these

441

00:14:39,350 --> 00:14:37,040

higher energy levels are less common

442

00:14:41,350 --> 00:14:39,360

and so it takes longer to know how

443

00:14:43,670 --> 00:14:41,360

accurate that estimate of its energy

444

00:14:46,069 --> 00:14:43,680

would be and so forth the other thing

445

00:14:48,470 --> 00:14:46,079

about them is those are the kinds of

446

00:14:49,670 --> 00:14:48,480

particles that you would expect if dark

447

00:14:51,110 --> 00:14:49,680

matter

448

00:14:54,069 --> 00:14:51,120

is interacting

449

00:14:56,470 --> 00:14:54,079

with itself in annihilating itself so so

450

00:14:58,069 --> 00:14:56,480

if you have two units of dark matter and

451

00:15:00,069 --> 00:14:58,079

they interact they'll annihilate each

452

00:15:02,470 --> 00:15:00,079

other and produce a positron and

453

00:15:04,949 --> 00:15:02,480

positrons are the particle that dr ting

454

00:15:07,350 --> 00:15:04,959

was reporting on last week so if you see

455

00:15:09,189 --> 00:15:07,360

a lot of high energy positrons if you

456

00:15:11,670 --> 00:15:09,199

see too many of them then that might

457

00:15:13,829 --> 00:15:11,680

indicate a normal kind of source like

458

00:15:16,310 --> 00:15:13,839

pulsar or something like that and if you

459

00:15:18,310 --> 00:15:16,320

see a medium amount that would suggest

460

00:15:19,910 --> 00:15:18,320

dark matter annihilation and if you see

461

00:15:21,670 --> 00:15:19,920

very very few then that would say our

462

00:15:25,110 --> 00:15:21,680

theory about dark matter is completely

463

00:15:27,590 --> 00:15:25,120

bogus um and so the data point that he

464

00:15:29,749 --> 00:15:27,600

showed last week was actually in between

465

00:15:33,110 --> 00:15:29,759

those two cases with a pretty big error

466

00:15:34,710 --> 00:15:33,120

bar so so it was almost a teaser rather

467

00:15:36,150 --> 00:15:34,720

you know it's not a result you just run

468

00:15:38,069 --> 00:15:36,160

to publish because it shows that he

469

00:15:38,949 --> 00:15:38,079

really needs to collect some additional

470

00:15:41,430 --> 00:15:38,959

data

471

00:15:43,509 --> 00:15:41,440

but it what's so exciting is to see that

472

00:15:45,829 --> 00:15:43,519

that energy 500 giga electron volts

473

00:15:47,990 --> 00:15:45,839

never observed by humankind before and

474

00:15:50,710 --> 00:15:48,000

that was the first presentation of it so

475

00:15:52,069 --> 00:15:50,720

50 billion readings wasn't enough

476

00:15:54,389 --> 00:15:52,079

how many more is he expecting probably

477

00:15:56,069 --> 00:15:54,399

needs 20 billion more at least