



1
00:00:07,349 --> 00:00:05,190
a major area of science on the

2
00:00:09,270 --> 00:00:07,359
international space station is studying

3
00:00:12,070 --> 00:00:09,280
how the space environment impacts the

4
00:00:14,950 --> 00:00:12,080
human body so we can better prepare for

5
00:00:16,790 --> 00:00:14,960
longer future deep space missions the

6
00:00:18,950 --> 00:00:16,800
launch of scott kelly and mikhail

7
00:00:20,950 --> 00:00:18,960
konienko less than three weeks from now

8
00:00:23,269 --> 00:00:20,960
on the first year-long mission to this

9
00:00:25,670 --> 00:00:23,279
station expands that research by

10
00:00:27,349 --> 00:00:25,680
studying crew members in space for a

11
00:00:29,349 --> 00:00:27,359
longer period of time

12
00:00:32,150 --> 00:00:29,359
but it does something else too taking

13
00:00:34,709 --> 00:00:32,160

advantage of the fact that kelly has an

14

00:00:35,590 --> 00:00:34,719

identical twin former astronaut mark

15

00:00:37,510 --> 00:00:35,600

kelly

16

00:00:40,549 --> 00:00:37,520

joining me this morning to discuss the

17

00:00:42,869 --> 00:00:40,559

twins study is dr craig kundra he is the

18

00:00:46,069 --> 00:00:42,879

deputy chief scientist nasa's human

19

00:00:48,709 --> 00:00:46,079

research program craig tell me how this

20

00:00:49,830 --> 00:00:48,719

idea to study twins came about well

21

00:00:50,869 --> 00:00:49,840

thanks very much for having me this

22

00:00:51,670 --> 00:00:50,879

morning

23

00:00:54,470 --> 00:00:51,680

um

24

00:00:56,950 --> 00:00:54,480

it began in november of 2012 when scott

25

00:00:59,110 --> 00:00:56,960

kelly and mikhail kornienko were named

26
00:01:00,790 --> 00:00:59,120
to the one year mission when scott kelly

27
00:01:02,630 --> 00:01:00,800
was meeting with

28
00:01:03,910 --> 00:01:02,640
scientists at nasa to discuss the

29
00:01:05,990 --> 00:01:03,920
science that would be done on the one

30
00:01:07,750 --> 00:01:06,000
year mission he asked the question if

31
00:01:10,310 --> 00:01:07,760
any of it would have to do with his twin

32
00:01:13,510 --> 00:01:10,320
brother mark retired astronaut

33
00:01:15,190 --> 00:01:13,520
our initial reaction was no uh we had

34
00:01:17,749 --> 00:01:15,200
just heard about this announcement and

35
00:01:19,109 --> 00:01:17,759
there were no twin studies in the queue

36
00:01:21,030 --> 00:01:19,119
and normally

37
00:01:22,230 --> 00:01:21,040
if we were to select a new set of

38
00:01:23,990 --> 00:01:22,240

experiments we would have probably

39

00:01:25,109 --> 00:01:24,000

wanted to start about a year earlier

40

00:01:27,270 --> 00:01:25,119

than that

41

00:01:29,910 --> 00:01:27,280

the second thought was no it's just two

42

00:01:31,429 --> 00:01:29,920

individuals and one twin pair

43

00:01:33,030 --> 00:01:31,439

and that's not our you know we usually

44

00:01:34,230 --> 00:01:33,040

want more subjects for statistical

45

00:01:36,149 --> 00:01:34,240

significance

46

00:01:38,230 --> 00:01:36,159

but then the third thought was hold it

47

00:01:40,069 --> 00:01:38,240

this is a chance in a lifetime we

48

00:01:42,310 --> 00:01:40,079

haven't really had this opportunity

49

00:01:45,109 --> 00:01:42,320

before and we don't see foresee that

50

00:01:47,350 --> 00:01:45,119

happening again anytime soon so let's

51
00:01:49,590 --> 00:01:47,360
seize the opportunity and make the best

52
00:01:51,510 --> 00:01:49,600
use of it and see what kind of

53
00:01:54,389 --> 00:01:51,520
experiments we can do

54
00:01:56,469 --> 00:01:54,399
on these two twins so how did you select

55
00:01:58,550 --> 00:01:56,479
the experiment so we put out a research

56
00:01:59,590 --> 00:01:58,560
announcement to the scientific community

57
00:02:01,830 --> 00:01:59,600
in the us

58
00:02:04,230 --> 00:02:01,840
and solicited ideas we had specific

59
00:02:07,109 --> 00:02:04,240
categories in mind and we got about 40

60
00:02:08,949 --> 00:02:07,119
proposals in response and we selected 10

61
00:02:11,110 --> 00:02:08,959
to span the gamut of things that we were

62
00:02:13,110 --> 00:02:11,120
interested in give me a sense then of

63
00:02:15,030 --> 00:02:13,120

what you're looking at i understand it's

64

00:02:17,430 --> 00:02:15,040

broken down into about four categories

65

00:02:19,510 --> 00:02:17,440

right there are four broad categories um

66

00:02:21,510 --> 00:02:19,520

so first we have the psychological

67

00:02:23,430 --> 00:02:21,520

aspect of space flight because we're

68

00:02:25,510 --> 00:02:23,440

very interested in understanding both

69

00:02:27,270 --> 00:02:25,520

how the human body and human mind

70

00:02:29,270 --> 00:02:27,280

respond to space flight so the first

71

00:02:31,110 --> 00:02:29,280

part is a study called cognition that

72

00:02:34,150 --> 00:02:31,120

will look at

73

00:02:35,430 --> 00:02:34,160

scott and mark during the

74

00:02:36,790 --> 00:02:35,440

not just the one year mission but like

75

00:02:38,869 --> 00:02:36,800

all the other experiments pre-flight and

76

00:02:40,309 --> 00:02:38,879

post-flight as well the second area is

77

00:02:41,990 --> 00:02:40,319

physiology

78

00:02:43,430 --> 00:02:42,000

uh we're looking at for example how the

79

00:02:45,670 --> 00:02:43,440

fluids shift in the body in

80

00:02:47,589 --> 00:02:45,680

weightlessness uh that could be a major

81

00:02:50,630 --> 00:02:47,599

contributor to the vision problems that

82

00:02:53,270 --> 00:02:50,640

we're seeing a rise in some astronauts a

83

00:02:55,670 --> 00:02:53,280

third area is looking at the microbiome

84

00:02:58,790 --> 00:02:55,680

these are the bacteria that live in our

85

00:03:01,190 --> 00:02:58,800

gut and we are outnumbered 10 to 1 on a

86

00:03:02,790 --> 00:03:01,200

cell count basis by bacteria in our gut

87

00:03:04,949 --> 00:03:02,800

and so we're looking at how

88

00:03:06,710 --> 00:03:04,959

that changes in scott who's got a

89

00:03:08,309 --> 00:03:06,720

special diet for a year in our

90

00:03:11,110 --> 00:03:08,319

relatively clean environment and how

91

00:03:13,430 --> 00:03:11,120

that compares to mark the fourth area is

92

00:03:15,589 --> 00:03:13,440

really brand new for nasa it's built on

93

00:03:17,430 --> 00:03:15,599

the the shoulders of the human genome

94

00:03:19,509 --> 00:03:17,440

project and the work that has resulted

95

00:03:21,030 --> 00:03:19,519

from that and that's the molecular level

96

00:03:23,270 --> 00:03:21,040

where we're looking at how genes are

97

00:03:25,750 --> 00:03:23,280

being turned on and off uh how that's

98

00:03:29,190 --> 00:03:25,760

resulting in changes in rna in the cells

99

00:03:30,949 --> 00:03:29,200

and changes in proteins and metabolites

100

00:03:33,509 --> 00:03:30,959

all resulting from the changes in the

101
00:03:35,350 --> 00:03:33,519
genes now all of those you could do on

102
00:03:37,509 --> 00:03:35,360
scott in space

103
00:03:40,949 --> 00:03:37,519
what what's the advantage of comparing

104
00:03:42,229 --> 00:03:40,959
it to whatever you find in mark on earth

105
00:03:44,229 --> 00:03:42,239
well the great thing is you know the

106
00:03:45,030 --> 00:03:44,239
classic question is you know how much of

107
00:03:52,470 --> 00:03:45,040
our

108
00:03:54,789 --> 00:03:52,480
nurture

109
00:03:57,270 --> 00:03:54,799
discussion so in this case we've got two

110
00:03:58,229 --> 00:03:57,280
genetically identical individuals

111
00:03:59,910 --> 00:03:58,239
and

112
00:04:03,030 --> 00:03:59,920
we can monitor what kind of changes

113
00:04:04,630 --> 00:04:03,040

occur in mark in an ordinary lifestyle

114

00:04:06,630 --> 00:04:04,640

and compare those to the changes that we

115

00:04:08,710 --> 00:04:06,640

see in scott in flight with essentially

116

00:04:10,390 --> 00:04:08,720

the same gene set and so when we see

117

00:04:12,710 --> 00:04:10,400

significant differences in scott that we

118

00:04:14,390 --> 00:04:12,720

don't see in mark then we're on to we

119

00:04:16,390 --> 00:04:14,400

have a good clue that there may be

120

00:04:17,670 --> 00:04:16,400

something to follow up on and then the

121

00:04:19,670 --> 00:04:17,680

environment is

122

00:04:21,030 --> 00:04:19,680

is responsible for change yeah it could

123

00:04:22,790 --> 00:04:21,040

be the weightlessness it could be

124

00:04:25,030 --> 00:04:22,800

radiation it could be

125

00:04:26,550 --> 00:04:25,040

the isolated confined nature uh there

126

00:04:28,469 --> 00:04:26,560

are several aspects of space flight

127

00:04:29,749 --> 00:04:28,479

which pose a challenge how are you going

128

00:04:32,150 --> 00:04:29,759

to gather data

129

00:04:33,990 --> 00:04:32,160

from the two subjects well on the

130

00:04:36,550 --> 00:04:34,000

molecular front

131

00:04:38,150 --> 00:04:36,560

we're collecting samples from saliva

132

00:04:41,430 --> 00:04:38,160

cheek

133

00:04:42,469 --> 00:04:41,440

urine feces and blood

134

00:04:45,350 --> 00:04:42,479

on the

135

00:04:47,030 --> 00:04:45,360

side the physiology

136

00:04:49,030 --> 00:04:47,040

we're using some instrumentation which

137

00:04:50,790 --> 00:04:49,040

we can only use on the ground like mris

138

00:04:52,230 --> 00:04:50,800

but we're also using instrumentation

139

00:04:54,070 --> 00:04:52,240

that we can use on the ground and in

140

00:04:55,990 --> 00:04:54,080

flight like ultrasound and then the

141

00:04:58,230 --> 00:04:56,000

cognition test that i mentioned earlier

142

00:05:00,710 --> 00:04:58,240

that's entirely on a laptop so that that

143

00:05:02,230 --> 00:05:00,720

works in both places so it's it's fairly

144

00:05:04,150 --> 00:05:02,240

straightforward and not not too

145

00:05:05,670 --> 00:05:04,160

complicated to uh to

146

00:05:07,510 --> 00:05:05,680

get the data to study it's another

147

00:05:09,270 --> 00:05:07,520

that's easy for you

148

00:05:11,189 --> 00:05:09,280

well and that was a key part of putting

149

00:05:13,270 --> 00:05:11,199

the twin study together is

150

00:05:15,830 --> 00:05:13,280

uh we didn't design any new equipment or

151
00:05:17,990 --> 00:05:15,840
anything for the study we capitalized on

152
00:05:19,749 --> 00:05:18,000
investigations already ongoing and then

153
00:05:22,390 --> 00:05:19,759
for this new molecular

154
00:05:25,590 --> 00:05:22,400
realm obtaining cheek and saliva and

155
00:05:28,230 --> 00:05:25,600
feces and blood is relatively easy

156
00:05:30,469 --> 00:05:28,240
the the experiments themselves are are

157
00:05:33,110 --> 00:05:30,479
related in that the experimenters are

158
00:05:35,029 --> 00:05:33,120
working cooperatively right that's right

159
00:05:39,430 --> 00:05:35,039
this is an unusual arrangement we

160
00:05:41,909 --> 00:05:39,440
selected 10 separate investigators and

161
00:05:44,950 --> 00:05:41,919
all working together we forged this into

162
00:05:46,790 --> 00:05:44,960
one large meta study if you will so all

163
00:05:48,790 --> 00:05:46,800

10 investigators are sharing data with

164

00:05:50,150 --> 00:05:48,800

one another

165

00:05:51,670 --> 00:05:50,160

sharing in the analysis they'll write

166

00:05:53,510 --> 00:05:51,680

papers together and one of the

167

00:05:54,390 --> 00:05:53,520

investigators did a similar type of

168

00:05:56,070 --> 00:05:54,400

study

169

00:05:57,590 --> 00:05:56,080

with one subject just doing the

170

00:06:00,150 --> 00:05:57,600

molecular part following that subject

171

00:06:01,830 --> 00:06:00,160

for 14 months so we have a good template

172

00:06:04,230 --> 00:06:01,840

on which to build but this is very

173

00:06:06,150 --> 00:06:04,240

unusual i'm not aware of another study

174

00:06:08,070 --> 00:06:06,160

like this even on on the ground where

175

00:06:10,629 --> 00:06:08,080

you've got so much molecular work as

176

00:06:12,230 --> 00:06:10,639

well as the physiology the psychology

177

00:06:15,110 --> 00:06:12,240

and the microbiome

178

00:06:17,110 --> 00:06:15,120

with one pair of subjects here i think

179

00:06:18,950 --> 00:06:17,120

that's not a statistically significant

180

00:06:20,390 --> 00:06:18,960

sample right but this is still worth

181

00:06:22,230 --> 00:06:20,400

doing absolutely

182

00:06:23,990 --> 00:06:22,240

yeah the normal twin study would involve

183

00:06:24,950 --> 00:06:24,000

tens hundreds maybe even thousands of

184

00:06:26,550 --> 00:06:24,960

twins

185

00:06:28,390 --> 00:06:26,560

well we don't have that many in the

186

00:06:30,550 --> 00:06:28,400

astronaut core we just have these two

187

00:06:32,629 --> 00:06:30,560

just in one set and so what we're

188

00:06:34,950 --> 00:06:32,639

expecting is that with the genetic

189

00:06:36,790 --> 00:06:34,960

identity underlying them they were in a

190

00:06:38,710 --> 00:06:36,800

good position to see some subtle changes

191

00:06:40,150 --> 00:06:38,720

that we wouldn't be able to see in two

192

00:06:41,510 --> 00:06:40,160

individuals who weren't

193

00:06:42,309 --> 00:06:41,520

identical twins

194

00:06:44,309 --> 00:06:42,319

now

195

00:06:46,550 --> 00:06:44,319

those will be clues it's very unlikely

196

00:06:48,309 --> 00:06:46,560

we'll have a definitive result from this

197

00:06:51,029 --> 00:06:48,319

study but we'll have clues that we can

198

00:06:52,550 --> 00:06:51,039

follow up then with normal research

199

00:06:55,189 --> 00:06:52,560

studies that would involve the normal

200

00:06:57,670 --> 00:06:55,199

number of astronauts so this is really a

201
00:07:00,710 --> 00:06:57,680
a discovery opportunity not likely to

202
00:07:03,270 --> 00:07:00,720
generate final conclusions and like most

203
00:07:04,710 --> 00:07:03,280
things with data gathering pre and post

204
00:07:07,110 --> 00:07:04,720
flight so

205
00:07:08,950 --> 00:07:07,120
it's you've got a year's worth of data

206
00:07:11,189 --> 00:07:08,960
gathering in front of you that's right

207
00:07:13,029 --> 00:07:11,199
that's right so we've we've already uh

208
00:07:13,990 --> 00:07:13,039
done several sessions of pre-flight data

209
00:07:15,990 --> 00:07:14,000
collection

210
00:07:18,230 --> 00:07:16,000
and now we're entering the flight phase

211
00:07:20,550 --> 00:07:18,240
then after flight there will be

212
00:07:22,629 --> 00:07:20,560
kind of an intense uh six months worth

213
00:07:24,150 --> 00:07:22,639

of data collection and then most of the

214

00:07:25,909 --> 00:07:24,160

twin study

215

00:07:28,629 --> 00:07:25,919

data and sample collections will stop

216

00:07:30,469 --> 00:07:28,639

six months after uh the mission a few go

217

00:07:33,110 --> 00:07:30,479

on because they were part of studies

218

00:07:35,350 --> 00:07:33,120

already in the uh portfolio and they'll

219

00:07:37,749 --> 00:07:35,360

go on a bit longer but the twin study

220

00:07:39,909 --> 00:07:37,759

for the whole will will wrap up in the

221

00:07:41,589 --> 00:07:39,919

fall of 2016 in terms of data and sample

222

00:07:43,909 --> 00:07:41,599

collection be interesting to see what

223

00:07:45,430 --> 00:07:43,919

you learned thanks very much for uh for

224

00:07:47,110 --> 00:07:45,440

telling us about it thanks for having me

225

00:07:49,189 --> 00:07:47,120

craig kundratt is the deputy chief

