
NASA
SPACESTATION
LIVE

1
00:00:08,950 --> 00:00:06,970
in parallel to the one-year mission

2
00:00:11,110 --> 00:00:08,960
research that crew member scott kelly

3
00:00:13,030 --> 00:00:11,120
and mikhail kornienko are taking part in

4
00:00:15,100 --> 00:00:13,040
kelly is participating in another study

5
00:00:17,740 --> 00:00:15,110
along with his twin brother former

6
00:00:20,140 --> 00:00:17,750
astronaut Mark Kelly in which scientists

7
00:00:22,600 --> 00:00:20,150
hope to learn more about how prolonged

8
00:00:25,450 --> 00:00:22,610
spaceflight affects the human body right

9
00:00:27,850 --> 00:00:25,460
down to the DNA and it's hoped those

10
00:00:30,160 --> 00:00:27,860
findings can contribute to helping keep

11
00:00:33,100 --> 00:00:30,170
future explorers safe on trips to deep

12
00:00:36,400 --> 00:00:33,110
space the first of its kind study in the

13
00:00:38,560 --> 00:00:36,410

emerging area of omics research is

14
00:00:41,080 --> 00:00:38,570
partially funded by the National Space

15
00:00:43,300 --> 00:00:41,090
Biomedical Research Institute and chief

16
00:00:45,880 --> 00:00:43,310
scientist dr. Graham Scott joins me this

17
00:00:47,890 --> 00:00:45,890
morning to tell us more good morning

18
00:00:50,440 --> 00:00:47,900
amiko and thank you for hosting me here

19
00:00:52,450 --> 00:00:50,450
in Mission Control good morning thank

20
00:00:55,810 --> 00:00:52,460
you so much for coming this is really

21
00:00:56,890 --> 00:00:55,820
fascinating interesting data so there's

22
00:00:58,870 --> 00:00:56,900
a lot of words that are being thrown

23
00:01:00,580 --> 00:00:58,880
around that not everybody is quite

24
00:01:02,229 --> 00:01:00,590
familiar with so we'll start with first

25
00:01:06,130 --> 00:01:02,239
of all how do you explain to folks about

26
00:01:09,330 --> 00:01:06,140
what omics research is sure so I makes

27
00:01:13,090 --> 00:01:09,340
means that you look at the totality of

28
00:01:14,680 --> 00:01:13,100
what's going on inside the cell so to

29
00:01:17,680 --> 00:01:14,690
make that a little more concrete for you

30
00:01:19,810 --> 00:01:17,690
about 12 years ago here on earth we

31
00:01:22,660 --> 00:01:19,820
completed the sequencing of the human

32
00:01:25,480 --> 00:01:22,670
genome and that the human genome is a

33
00:01:28,060 --> 00:01:25,490
recipe it's a parts list if you if you

34
00:01:33,219 --> 00:01:28,070
will for a human being and so once we

35
00:01:36,609 --> 00:01:33,229
have that genome we can then use it and

36
00:01:38,590 --> 00:01:36,619
project if you like or extrapolate out

37
00:01:41,590 --> 00:01:38,600
from that and figure out what proteins

38
00:01:43,780 --> 00:01:41,600

might be might be made because DNA is

39
00:01:46,630 --> 00:01:43,790
really a recipe for making proteins and

40
00:01:48,550 --> 00:01:46,640
so we can look inside the cells we can

41
00:01:51,700 --> 00:01:48,560
look look to see what proteins we can

42
00:01:53,890 --> 00:01:51,710
observe we can look to see what specific

43
00:01:57,550 --> 00:01:53,900
gene variations we see in a particular

44
00:02:00,340 --> 00:01:57,560
person and what what this whole area of

45
00:02:02,890 --> 00:02:00,350
omics is doing is it's really opening a

46
00:02:05,350 --> 00:02:02,900
new chapter in medicine so now in the

47
00:02:07,960 --> 00:02:05,360
future when you go to visit your doctor

48
00:02:10,330 --> 00:02:07,970
or if you go to a hospital like MD

49
00:02:12,489 --> 00:02:10,340
Anderson one of the things that will be

50
00:02:13,730 --> 00:02:12,499
done is a genomic sequence to really

51
00:02:16,490 --> 00:02:13,740
figure out

52
00:02:18,950 --> 00:02:16,500
how you might be different small

53
00:02:20,620 --> 00:02:18,960
differences any two people are about

54
00:02:22,490 --> 00:02:20,630
ninety nine point five percent

55
00:02:24,170 --> 00:02:22,500
equivalent so there's about half a

56
00:02:26,210 --> 00:02:24,180
percent difference genetically between

57
00:02:27,770 --> 00:02:26,220
any two people but they can make a big

58
00:02:30,110 --> 00:02:27,780
difference in terms of drugs that are

59
00:02:33,350 --> 00:02:30,120
being prescribed how we sleep how we

60
00:02:35,240 --> 00:02:33,360
exercise all of these things so alex is

61
00:02:38,440 --> 00:02:35,250
looking at the totality at the

62
00:02:41,180 --> 00:02:38,450
collective milieu if you will of

63
00:02:43,370 --> 00:02:41,190

biomolecules data within the cells and

64
00:02:45,350 --> 00:02:43,380
so what does this really mean for you as

65
00:02:47,450 --> 00:02:45,360
a subject or research subject or a

66
00:02:49,520 --> 00:02:47,460
patient or for Scott Kelly on orbit it

67
00:02:51,170 --> 00:02:49,530
means that we're drawing blood we're

68
00:02:53,780 --> 00:02:51,180
looking at the saliva we're looking at

69
00:02:55,850 --> 00:02:53,790
the urine primarily biofluids and then

70
00:02:57,710 --> 00:02:55,860
we can repatriate those biofluids in the

71
00:02:59,560 --> 00:02:57,720
case of Scott Kelly back down here to

72
00:03:02,750 --> 00:02:59,570
earth and then we can use sophisticated

73
00:03:05,180 --> 00:03:02,760
molecular diagnostic techniques such as

74
00:03:08,030 --> 00:03:05,190
DNA sequencing to really look and see

75
00:03:10,550 --> 00:03:08,040
what is going on with his DNA with his

76
00:03:12,320 --> 00:03:10,560
proteins with his RNA and in this case

77
00:03:14,480 --> 00:03:12,330
what's really beautiful is we can do

78
00:03:17,240 --> 00:03:14,490
this relative to his brother okay who's

79
00:03:18,860 --> 00:03:17,250
essentially genetically identical to

80
00:03:21,790 --> 00:03:18,870
Scott that's what I was going to ask you

81
00:03:24,430 --> 00:03:21,800
about the you know what what how the the

82
00:03:27,610 --> 00:03:24,440
comparison of the two of them and what I

83
00:03:29,510 --> 00:03:27,620
mean obviously that's a very unique

84
00:03:33,110 --> 00:03:29,520
opportunity that we have but how does

85
00:03:38,750 --> 00:03:33,120
that actually in terms of comparing his

86
00:03:41,060 --> 00:03:38,760
DNA how does that help help whip this

87
00:03:43,250 --> 00:03:41,070
research even more say that right so in

88
00:03:46,340 --> 00:03:43,260

any experiment you like to have controls

89
00:03:48,560 --> 00:03:46,350
you like to have a research subject that

90
00:03:50,180 --> 00:03:48,570
you're you're doing an experiment on and

91
00:03:52,670 --> 00:03:50,190
then you and then typically you'll have

92
00:03:54,380 --> 00:03:52,680
a group often a group of research

93
00:03:56,030 --> 00:03:54,390
subjects we're whether in some

94
00:03:58,070 --> 00:03:56,040
controlled environment so here what

95
00:03:59,690 --> 00:03:58,080
we've got is we've got Scott Kelly on

96
00:04:02,960 --> 00:03:59,700
all but being subjected to microgravity

97
00:04:04,850 --> 00:04:02,970
space radiation close confinement all of

98
00:04:06,980 --> 00:04:04,860
the stresses of that space environment

99
00:04:09,470 --> 00:04:06,990
in my Kelly's here on earth and he is

100
00:04:11,600 --> 00:04:09,480
essentially leading a normal life now

101
00:04:14,390 --> 00:04:11,610
that the really elegant thing is these

102
00:04:15,729 --> 00:04:14,400
two individuals to a very good order of

103
00:04:18,770 --> 00:04:15,739
approximation are genetically identical

104
00:04:21,260 --> 00:04:18,780
so what we can drive towards here is

105
00:04:23,480 --> 00:04:21,270
there is this very fundamental question

106
00:04:25,700 --> 00:04:23,490
of nature versus nurture because these

107
00:04:27,050 --> 00:04:25,710
two individuals to a very good order

108
00:04:29,060 --> 00:04:27,060
approximation all right

109
00:04:30,950 --> 00:04:29,070
unicord genetically so therefore when we

110
00:04:32,330 --> 00:04:30,960
look and see when we do this omics

111
00:04:34,070 --> 00:04:32,340
research which again is looking at the

112
00:04:36,290 --> 00:04:34,080
totality of how the molecules are

113
00:04:38,810 --> 00:04:36,300

changing inside your cells we have this

114
00:04:40,460 --> 00:04:38,820
theory we have the best control that you

115
00:04:42,290 --> 00:04:40,470
could that you could dream of right

116
00:04:44,659 --> 00:04:42,300
because they're genetically identical so

117
00:04:47,450 --> 00:04:44,669
it really drives at this nature versus

118
00:04:50,780 --> 00:04:47,460
nurture question and so what so what we

119
00:04:52,430 --> 00:04:50,790
can then infer potentially is if we see

120
00:04:55,370 --> 00:04:52,440
differences between the two twin

121
00:04:58,700 --> 00:04:55,380
brothers we can say well we sort of

122
00:05:00,530 --> 00:04:58,710
taking the nature piece a little bit to

123
00:05:02,960 --> 00:05:00,540
some extent at least a very large extent

124
00:05:04,940 --> 00:05:02,970
out of the equation because the nurture

125
00:05:06,590 --> 00:05:04,950
the environment is really influencing

126
00:05:08,510 --> 00:05:06,600
those differences potentially between

127
00:05:10,879 --> 00:05:08,520
the 20 and we're also tracking each

128
00:05:12,620 --> 00:05:10,889
point over time so not only are we

129
00:05:14,690 --> 00:05:12,630
comparing the twin brothers to one

130
00:05:16,820 --> 00:05:14,700
another but we're looking at in the case

131
00:05:18,560 --> 00:05:16,830
of scott kelly and Mark as well they're

132
00:05:20,570 --> 00:05:18,570
how their bio molecules are performing

133
00:05:22,159 --> 00:05:20,580
before flight in the case of Scott

134
00:05:24,020 --> 00:05:22,169
during flight and then after floaters

135
00:05:26,659 --> 00:05:24,030
yeah so it's a really really nicely

136
00:05:28,430 --> 00:05:26,669
designed stuff yeah and and I can see

137
00:05:31,340 --> 00:05:28,440
you know how that it'll be very

138
00:05:32,750 --> 00:05:31,350

fascinating to see how you know the

139
00:05:35,750 --> 00:05:32,760
environment just the factors of

140
00:05:38,000 --> 00:05:35,760
environment can can change and how our

141
00:05:40,700 --> 00:05:38,010
body reacts to that so that's it's very

142
00:05:42,469 --> 00:05:40,710
interesting so tell me now you i had i

143
00:05:45,920 --> 00:05:42,479
know you've written about the

144
00:05:48,110 --> 00:05:45,930
development of precision medicine um can

145
00:05:51,500 --> 00:05:48,120
you describe that's right that's right

146
00:05:53,240 --> 00:05:51,510
so now because we have the ability to do

147
00:05:55,430 --> 00:05:53,250
genomic sequencing which by the way you

148
00:05:58,340 --> 00:05:55,440
can do for about a thousand dollars this

149
00:06:00,590 --> 00:05:58,350
is about the price narrow of an MRI of

150
00:06:02,240 --> 00:06:00,600
you know if you were to go in and have

151
00:06:04,430 --> 00:06:02,250
some part of your body image it's about

152
00:06:06,200 --> 00:06:04,440
the same price that's becoming very very

153
00:06:08,900 --> 00:06:06,210
affordable so now with this genomic

154
00:06:10,490 --> 00:06:08,910
information we can actually look at

155
00:06:13,370 --> 00:06:10,500
there's a half a percent difference

156
00:06:16,219 --> 00:06:13,380
between between any two individuals and

157
00:06:18,200 --> 00:06:16,229
what that can and this is increasingly

158
00:06:20,420 --> 00:06:18,210
permeating into different areas of

159
00:06:22,820 --> 00:06:20,430
medicine let's take oncology as an

160
00:06:25,129 --> 00:06:22,830
example so if somebody was to go to md

161
00:06:27,020 --> 00:06:25,139
anderson and they were to be diagnosed

162
00:06:29,510 --> 00:06:27,030
with cancer one of the first things that

163
00:06:32,210 --> 00:06:29,520

would be done is some genomic sequencing

164
00:06:34,330 --> 00:06:32,220
to look at some specific genes why are

165
00:06:37,760 --> 00:06:34,340
we doing that well we want to prescribe

166
00:06:39,620 --> 00:06:37,770
the really tailored treatment for the

167
00:06:40,610 --> 00:06:39,630
patient we know what the last thing we

168
00:06:43,040 --> 00:06:40,620
want to do is put a page

169
00:06:45,050 --> 00:06:43,050
on three months of chemotherapy and it's

170
00:06:47,290 --> 00:06:45,060
not effective so if we do this genomic

171
00:06:50,570 --> 00:06:47,300
sequencing we can look at the specific

172
00:06:52,370 --> 00:06:50,580
variants the specific genomic makeup if

173
00:06:54,050 --> 00:06:52,380
you will of an individual and decide

174
00:06:56,750 --> 00:06:54,060
whether a particular medicine will be

175
00:06:58,760 --> 00:06:56,760
effective most likely or not so we're

176
00:07:01,280 --> 00:06:58,770
really targeting we're doing in a very

177
00:07:04,520 --> 00:07:01,290
precise way where we're in business

178
00:07:06,590 --> 00:07:04,530
genomic information within informing the

179
00:07:08,030 --> 00:07:06,600
treatment and so this is the kind of

180
00:07:09,680 --> 00:07:08,040
paradigm that we're increasingly going

181
00:07:11,330 --> 00:07:09,690
to see spreading out through all

182
00:07:13,760 --> 00:07:11,340
different areas of Medicine and what

183
00:07:16,460 --> 00:07:13,770
we'd like to do is bring this precision

184
00:07:18,650 --> 00:07:16,470
medicine strategy bring it to NASA

185
00:07:20,120 --> 00:07:18,660
because one of the things that we're

186
00:07:21,950 --> 00:07:20,130
going to need to do on these very

187
00:07:23,420 --> 00:07:21,960
demanding long-duration missions like

188
00:07:25,969 --> 00:07:23,430

that it was going to be my next question

189
00:07:28,250 --> 00:07:25,979
how is this precision medicine going to

190
00:07:29,900 --> 00:07:28,260
help us keep our astronauts safe for

191
00:07:31,760 --> 00:07:29,910
those future mission well we'll let me

192
00:07:34,400 --> 00:07:31,770
let me let me give you an example of how

193
00:07:35,960 --> 00:07:34,410
this might be beneficial so right now on

194
00:07:37,760 --> 00:07:35,970
the space station we have a number of

195
00:07:41,360 --> 00:07:37,770
medicines and there are no they're in a

196
00:07:43,310 --> 00:07:41,370
large kit and and but it's somewhat

197
00:07:45,020 --> 00:07:43,320
generic there there are there are all

198
00:07:46,400 --> 00:07:45,030
different kinds of medicines for example

199
00:07:48,680 --> 00:07:46,410
there are sleep medications there are

200
00:07:51,290 --> 00:07:48,690
medications for pain relief these types

201
00:07:54,440 --> 00:07:51,300
of things but it's not specifically

202
00:07:55,879 --> 00:07:54,450
tailored to an individual's makeup so

203
00:07:57,469 --> 00:07:55,889
what we'd like to do particularly on a

204
00:07:59,690 --> 00:07:57,479
long-duration mission where there really

205
00:08:01,370 --> 00:07:59,700
isn't an opportunity to bring the

206
00:08:03,379 --> 00:08:01,380
astronaut back to earth if there is a

207
00:08:06,140 --> 00:08:03,389
medical emergency we like to make sure

208
00:08:08,690 --> 00:08:06,150
that the correct the tailored the really

209
00:08:11,420 --> 00:08:08,700
tailored drugs are on board for each

210
00:08:13,790 --> 00:08:11,430
individual astronaut other ways that

211
00:08:15,589 --> 00:08:13,800
this could come in right now you're

212
00:08:17,089 --> 00:08:15,599
aware that some of our astronauts and

213
00:08:20,150 --> 00:08:17,099

paid all the restaurants are exercising

214
00:08:21,950 --> 00:08:20,160
at least maybe two hours a day but we

215
00:08:24,200 --> 00:08:21,960
also when they return to if we see quite

216
00:08:26,870 --> 00:08:24,210
a bit of variation in their muscle mass

217
00:08:28,640 --> 00:08:26,880
and their bone mass maybe not every

218
00:08:30,050 --> 00:08:28,650
single one of them needs to exercise two

219
00:08:31,850 --> 00:08:30,060
hours ago maybe they could it maybe

220
00:08:33,140 --> 00:08:31,860
someone could exercise less maybe some

221
00:08:36,350 --> 00:08:33,150
of them need to exercise a little more

222
00:08:38,029 --> 00:08:36,360
so it's about really tailoring these

223
00:08:41,000 --> 00:08:38,039
countermeasures in a very precise way

224
00:08:43,610 --> 00:08:41,010
and using genomic information for each a

225
00:08:45,820 --> 00:08:43,620
personalized exactly to help us do that

226
00:08:48,290 --> 00:08:45,830
so now you've got molecular information

227
00:08:51,650 --> 00:08:48,300
so rather than having to put people

228
00:08:52,940 --> 00:08:51,660
through a whole lot of sort of exercises

229
00:08:54,240 --> 00:08:52,950
and tests are on the ground maybe you

230
00:08:56,910 --> 00:08:54,250
can use their genetic and

231
00:08:58,890 --> 00:08:56,920
mention very simple blood is to predict

232
00:09:02,190 --> 00:08:58,900
what medicines to take on the space

233
00:09:06,660 --> 00:09:02,200
station how long someone might need to

234
00:09:08,100 --> 00:09:06,670
exercise maybe what sort of how their

235
00:09:09,690 --> 00:09:08,110
how they're sleeping arrangements should

236
00:09:11,700 --> 00:09:09,700
be in terms of lighting countermeasures

237
00:09:13,610 --> 00:09:11,710
or how long they might need to sleep how

238
00:09:16,110 --> 00:09:13,620

susceptible they are to space radiation

239
00:09:19,620 --> 00:09:16,120
these types of things could really help

240
00:09:21,720 --> 00:09:19,630
us plan and execute a long-duration

241
00:09:23,760 --> 00:09:21,730
mission much more safely it is extremely

242
00:09:25,260 --> 00:09:23,770
fascinating and I'm so happy you came

243
00:09:26,880 --> 00:09:25,270
out to talk to us obviously there's a

244
00:09:28,410 --> 00:09:26,890
ton of information that we could go on

245
00:09:30,450 --> 00:09:28,420
and on and on I don't have all that time

246
00:09:33,150 --> 00:09:30,460
but I really appreciate you coming out I

247
00:09:35,340 --> 00:09:33,160
know you have also talked you've written

248
00:09:39,390 --> 00:09:35,350
a blog about it there's a two-part blog

249
00:09:41,640 --> 00:09:39,400
see online you can go get that blog

250
00:09:45,030 --> 00:09:41,650
available online now at blogs nasa.gov

251
00:09:47,340 --> 00:09:45,040
slash ISS underscores science underscore

252
00:09:48,690 --> 00:09:47,350
blog again dr. Graham Scott thank you so