1
00:00:04,150 --> 00:00:02,389
in addition to the opals experiment

2
00:00:07,190 --> 00:00:04,160
there are a number of other experiments

3
00:00:09,110 --> 00:00:07,200
that will be going up on the spacex

4
00:00:11,030 --> 00:00:09,120
dragon when it launches and one of them

5
00:00:14,470 --> 00:00:11,040
was developed by the merck research

6
00:00:17,269 --> 00:00:14,480
laboratories in new jersey

7
00:00:20,390 --> 00:00:17,279
that one will focus on crystallizing a

8
00:00:23,029 --> 00:00:20,400
human monoclonal antibody to advance the

9
00:00:24,790 --> 00:00:23,039
treatment of an immunological disorder

10
00:00:27,429 --> 00:00:24,800
and we talked earlier this week with the

11
00:00:29,269 --> 00:00:27,439
principal investigator of the experiment

12
00:00:31,429 --> 00:00:29,279
uh paul reichardt

13
00:00:33,190 --> 00:00:31,439

how did merk get interested in this uh

14
00:00:35,510 --> 00:00:33,200
subject

15
00:00:37,510 --> 00:00:35,520
well let me give some antibodies or

16
00:00:40,549 --> 00:00:37,520
proteins which are produced by your

17
00:00:41,830 --> 00:00:40,559
immune system to target alien cells

18
00:00:44,630 --> 00:00:41,840
bacteria

19
00:00:47,430 --> 00:00:44,640
viruses and proteins which are foreign

20
00:00:49,029 --> 00:00:47,440
substances in your body

21
00:00:51,430 --> 00:00:49,039
we actually are flying two monocle

22
00:00:53,430 --> 00:00:51,440
antibodies used in these experiments

23
00:00:55,750 --> 00:00:53,440
we're engineered to target specific

24
00:00:59,029 --> 00:00:55,760
human proteins that have been found to

25
00:01:01,189 --> 00:00:59,039
be implicated in multiple human diseases

26
00:01:02,869 --> 00:01:01,199
okay so and this is an antibody that

27
00:01:04,950 --> 00:01:02,879
you're you're already studying here on

28
00:01:05,750 --> 00:01:04,960
the ground right

29
00:01:08,070 --> 00:01:05,760
yes

30
00:01:09,750 --> 00:01:08,080
how is it different um having a space

31
00:01:11,109 --> 00:01:09,760
grown crystal of the antibody how does

32
00:01:14,710 --> 00:01:11,119
that how does that contribute to the

33
00:01:17,670 --> 00:01:14,720
work um well um we

34
00:01:21,350 --> 00:01:17,680
at this time uh there have been only

35
00:01:24,149 --> 00:01:21,360
six human antibodies structured uh by a

36
00:01:26,789 --> 00:01:24,159
procedure called x-ray crystallography

37
00:01:29,270 --> 00:01:26,799
which uses high quality single crystals

38
00:01:31,429 --> 00:01:29,280

in order to derive the structure

39
00:01:34,550 --> 00:01:31,439
our hope is that microgravity with the

40
00:01:36,710 --> 00:01:34,560
advantages of minimal sedimentation and

41
00:01:38,789 --> 00:01:36,720
convection currents will allow us to

42
00:01:41,510 --> 00:01:38,799
grow crystals which diffract to high

43
00:01:43,270 --> 00:01:41,520
resolution in order to get a structure

44
00:01:45,270 --> 00:01:43,280
the structure can be used to understand

45
00:01:47,670 --> 00:01:45,280
how the antibody binds to the target

46
00:01:49,990 --> 00:01:47,680
protein as well as help us understand

47
00:01:52,389 --> 00:01:50,000
how to make safer and easier to take

48
00:01:55,670 --> 00:01:52,399
medications for our patients

49
00:01:57,670 --> 00:01:55,680
so it's is it likely that the higher

50
00:01:59,670 --> 00:01:57,680
quality crystals would be more effective

51
00:02:03,109 --> 00:01:59,680
or just better to study

52
00:02:04,950 --> 00:02:03,119
um i i think that primarily uh

53
00:02:06,469 --> 00:02:04,960
uh initially we're hoping that the

54
00:02:07,590 --> 00:02:06,479
structure will

55
00:02:09,830 --> 00:02:07,600
allow us

56
00:02:12,710 --> 00:02:09,840
to better understand

57
00:02:14,390 --> 00:02:12,720
how the antibody works and to how to

58
00:02:17,350 --> 00:02:14,400
formulate it

59
00:02:19,990 --> 00:02:17,360
to make a preparation

60
00:02:21,350 --> 00:02:20,000
that one that patients could take more

61
00:02:23,750 --> 00:02:21,360
easily

62
00:02:25,270 --> 00:02:23,760
as well as increase the compliance make

63
00:02:26,550 --> 00:02:25,280

it easier

64
00:02:28,869 --> 00:02:26,560
for patients

65
00:02:31,670 --> 00:02:28,879
to take it in a doctor's office

66
00:02:33,910 --> 00:02:31,680
rather than to get a constant infusion

67
00:02:36,630 --> 00:02:33,920
is way a lot of monoclonal

68
00:02:38,949 --> 00:02:36,640
antibodies are delivered today okay i

69
00:02:41,190 --> 00:02:38,959
see well can you tell us how this will

70
00:02:43,110 --> 00:02:41,200
work on station what what what did the

71
00:02:44,550 --> 00:02:43,120
astronauts actually do or or what it's

72
00:02:45,430 --> 00:02:44,560
done from here on the ground

73
00:02:48,229 --> 00:02:45,440
okay

74
00:02:49,670 --> 00:02:48,239
we're setting up about 30 experiments

75
00:02:51,830 --> 00:02:49,680
for each one of the monoclonal

76
00:02:53,750 --> 00:02:51,840
antibodies and basically we're

77
00:02:56,070 --> 00:02:53,760
bracketing the conditions

78
00:02:58,630 --> 00:02:56,080
which we know the crystals will grow on

79
00:03:00,470 --> 00:02:58,640
earth but also anticipating that

80
00:03:03,190 --> 00:03:00,480
crystallization processes and

81
00:03:05,750 --> 00:03:03,200
microgravity often slower

82
00:03:07,670 --> 00:03:05,760
molecules move slower which we are

83
00:03:09,430 --> 00:03:07,680
trying to take advantage of to get

84
00:03:11,750 --> 00:03:09,440
higher water crystals

85
00:03:14,470 --> 00:03:11,760
okay i know also that you've done a

86
00:03:16,390 --> 00:03:14,480
number of similar maybe not similar but

87
00:03:18,390 --> 00:03:16,400
crystal growth experiments on the space

88
00:03:20,309 --> 00:03:18,400

station before and

89
00:03:22,630 --> 00:03:20,319
on space shuttle missions as well are

90
00:03:24,309 --> 00:03:22,640
those were those precursors to this did

91
00:03:26,789 --> 00:03:24,319
you learn things there that that led to

92
00:03:29,830 --> 00:03:26,799
this experiment well in my earlier

93
00:03:32,470 --> 00:03:29,840
experiments i was investigating a

94
00:03:33,750 --> 00:03:32,480
another biologic drug called alpha

95
00:03:39,589 --> 00:03:33,760
interferon

96
00:03:43,350 --> 00:03:39,599
as a therapeutic for like the last 18

97
00:03:44,869 --> 00:03:43,360
years for hepatitis c infections

98
00:03:46,949 --> 00:03:44,879
and our interest

99
00:03:49,589 --> 00:03:46,959
was to grow crystals for structure

100
00:03:52,149 --> 00:03:49,599
formulation and purification

101
00:03:55,110 --> 00:03:52,159
interestingly in in all the experiments

102
00:03:57,429 --> 00:03:55,120
we did we can never predict uh what

103
00:03:58,869 --> 00:03:57,439
would give us the crystals that we're

104
00:04:00,869 --> 00:03:58,879
looking for

105
00:04:04,070 --> 00:04:00,879
when we designed the experiments to get

106
00:04:06,390 --> 00:04:04,080
large single crystals we often got

107
00:04:07,830 --> 00:04:06,400
showers of small crystals

108
00:04:11,110 --> 00:04:07,840
and when when we designed the

109
00:04:12,789 --> 00:04:11,120
experiments to get showers we often got

110
00:04:14,949 --> 00:04:12,799
large single crystals

111
00:04:17,030 --> 00:04:14,959
uh the crystals we got from space were

112
00:04:18,229 --> 00:04:17,040
larger in some experiments and more

113
00:04:20,789 --> 00:04:18,239

uniform

114
00:04:22,469 --> 00:04:20,799
crystalline suspensions than the ones we

115
00:04:24,950 --> 00:04:22,479
found in the comparable earth

116
00:04:27,030 --> 00:04:24,960
experiments we were able to get a better

117
00:04:29,270 --> 00:04:27,040
structure and the protein after

118
00:04:32,150 --> 00:04:29,280
crystallization was pure then the same

119
00:04:33,830 --> 00:04:32,160
crystals dissolved in our earth control

120
00:04:36,950 --> 00:04:33,840
experiments

121
00:04:39,830 --> 00:04:36,960
straightforward

122
00:04:41,670 --> 00:04:39,840
that's why i'm actually very

123
00:04:43,590 --> 00:04:41,680
curious to see what's going to happen on

124
00:04:46,230 --> 00:04:43,600
this spacex 3

125
00:04:48,550 --> 00:04:46,240
to see if our experience with

126
00:04:49,909 --> 00:04:48,560
the monoclonal antibodies will be

127
00:04:52,710 --> 00:04:49,919
similar

128
00:04:55,350 --> 00:04:52,720
than what we found with alpha interferon

129
00:04:58,070 --> 00:04:55,360
and i guess that it's just the the lack

130
00:04:59,749 --> 00:04:58,080
of gravity that helps um with the growth

131
00:05:01,749 --> 00:04:59,759
of the crystal

132
00:05:03,830 --> 00:05:01,759
is that all that it is actually

133
00:05:04,629 --> 00:05:03,840
no actually it's two things one is it's

134
00:05:13,430 --> 00:05:04,639
the

135
00:05:15,749 --> 00:05:13,440
kind of crystals that most people are

136
00:05:18,230 --> 00:05:15,759
aware of these these are microscopic

137
00:05:20,469 --> 00:05:18,240
crystals and they grow in solutions

138
00:05:23,909 --> 00:05:20,479

so they're actually in water solutions

139
00:05:26,550 --> 00:05:23,919
and actually bob in the in the solution

140
00:05:27,749 --> 00:05:26,560
so the advantage in space

141
00:05:30,469 --> 00:05:27,759
is that

142
00:05:33,270 --> 00:05:30,479
these crystals rather than then drop in

143
00:05:35,430 --> 00:05:33,280
the solution due to gravity they stay

144
00:05:37,909 --> 00:05:35,440
suspended and they can be fed protein

145
00:05:40,469 --> 00:05:37,919
from all different size and that's how

146
00:05:42,070 --> 00:05:40,479
you get large single crystals okay the

147
00:05:46,790 --> 00:05:42,080
second effect

148
00:05:49,270 --> 00:05:46,800
temperature difference um on earth most

149
00:05:51,909 --> 00:05:49,280
people know that if you heat a solution

150
00:05:53,749 --> 00:05:51,919
you get this swirling effect

151
00:05:55,990 --> 00:05:53,759
in the solution itself as you're trying

152
00:05:57,590 --> 00:05:56,000
to heat it up this is convection

153
00:06:01,270 --> 00:05:57,600
currents that you get

154
00:06:02,710 --> 00:06:01,280
but in microgravity you get very very

155
00:06:04,469 --> 00:06:02,720
uniform

156
00:06:07,189 --> 00:06:04,479
temperature gradients

157
00:06:09,590 --> 00:06:07,199
which is a unique property uh to take

158
00:06:12,469 --> 00:06:09,600
advantage of um that a lot of people

159
00:06:14,309 --> 00:06:12,479
haven't in the past and i i hope

160
00:06:16,870 --> 00:06:14,319
in the future is something that we're

161
00:06:18,629 --> 00:06:16,880
going to uh take advantage of

162
00:06:20,710 --> 00:06:18,639
definitely sounds promising

163
00:06:22,790 --> 00:06:20,720

so how long will this experiment take

164
00:06:25,909 --> 00:06:22,800
and how long before you would have it

165
00:06:27,909 --> 00:06:25,919
back on the ground for study um we are

166
00:06:28,950 --> 00:06:27,919
very fortunate

167
00:06:31,909 --> 00:06:28,960
in that

168
00:06:33,830 --> 00:06:31,919
our experiments going to go on in a

169
00:06:36,950 --> 00:06:33,840
stowage bag

170
00:06:38,870 --> 00:06:36,960
what's going to end up on the u.s

171
00:06:41,670 --> 00:06:38,880
national laboratory

172
00:06:44,870 --> 00:06:41,680
where the experiment will be activated

173
00:06:48,469 --> 00:06:44,880
and will remain there for the duration

174
00:06:50,550 --> 00:06:48,479
that the dragon module is a

175
00:06:52,309 --> 00:06:50,560
attached to the international space

176
00:06:54,070 --> 00:06:52,319
station

177
00:06:55,589 --> 00:06:54,080
a day before

178
00:06:57,670 --> 00:06:55,599
the dragon

179
00:07:00,469 --> 00:06:57,680
will be disconnected

180
00:07:03,589 --> 00:07:00,479
our experiment will be deactivated and

181
00:07:05,510 --> 00:07:03,599
placed back on the dragon module

182
00:07:08,230 --> 00:07:05,520
where it will be

183
00:07:09,990 --> 00:07:08,240
hopefully a parachute down

184
00:07:12,150 --> 00:07:10,000
in the pacific ocean

185
00:07:14,469 --> 00:07:12,160
and within two days we'll pick up our

186
00:07:16,629 --> 00:07:14,479
experiment in california

187
00:07:18,710 --> 00:07:16,639
so i think from the time that uh we're

188
00:07:22,070 --> 00:07:18,720

anticipating this would be around 30

189
00:07:23,189 --> 00:07:22,080
days uh total time from the time after

190
00:07:25,749 --> 00:07:23,199
launch

191
00:07:28,550 --> 00:07:25,759
that we will get our experiment back

192
00:07:29,670 --> 00:07:28,560
um at that time um

193
00:07:33,189 --> 00:07:29,680
we will

194
00:07:34,469 --> 00:07:33,199
look at both our ground-based and flight

195
00:07:35,749 --> 00:07:34,479
experiments

196
00:07:37,589 --> 00:07:35,759
uh we'll

197
00:07:38,870 --> 00:07:37,599
photograph the crystals

198
00:07:40,790 --> 00:07:38,880
we'll do

199
00:07:43,990 --> 00:07:40,800
x-ray experiments

200
00:07:46,550 --> 00:07:44,000
uh to compare the quality within the

201
00:07:48,150 --> 00:07:46,560
crystals on both the

202
00:07:50,869 --> 00:07:48,160
ground and flight

203
00:07:53,510 --> 00:07:50,879
experiments we'll also hopefully will

204
00:07:54,790 --> 00:07:53,520
get some information about the purity

205
00:07:56,150 --> 00:07:54,800
and one of the things i'm very

206
00:07:58,629 --> 00:07:56,160
interested in is seeing what the

207
00:08:00,309 --> 00:07:58,639
particle size distribution will be for

208
00:08:02,150 --> 00:08:00,319
drug delivery

209
00:08:04,309 --> 00:08:02,160
i think we will probably be able to

210
00:08:05,430 --> 00:08:04,319
complete all these studies within one to

211
00:08:07,589 --> 00:08:05,440
three months

212
00:08:09,110 --> 00:08:07,599
well that's that's very fast

213
00:08:10,950 --> 00:08:09,120

well thank you so much for telling us

214
00:08:12,550 --> 00:08:10,960
about the the study we really appreciate

215
00:08:14,710 --> 00:08:12,560
it and we hope to hear more in the