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PRINCIPAL INVESTIGATOR,
ANTIOBIOTIC EFFECTIVENESS
IN SPACE
BIOSERVE SPACE TECHNOLOGIES,
UNIVERSITY OF COLORADO

1
00:00:06,150 --> 00:00:03,510
the team here in mission control is

2
00:00:07,909 --> 00:00:06,160
still assessing exactly how the problems

3
00:00:10,070 --> 00:00:07,919
with the cooling loop will be affecting

4
00:00:12,789 --> 00:00:10,080
the schedule for the station's upcoming

5
00:00:16,470 --> 00:00:12,799
events including uh the launch planned

6
00:00:18,470 --> 00:00:16,480
for next week of the cygnus uh vehicle

7
00:00:20,630 --> 00:00:18,480
but once the cygnus vehicle does go

8
00:00:21,910 --> 00:00:20,640
it'll be carrying to space several new

9
00:00:24,950 --> 00:00:21,920
experiments for the space station and we

10
00:00:26,310 --> 00:00:24,960
have with us today uh via phone dr david

11
00:00:27,830 --> 00:00:26,320
klaus to tell us about one of those

12
00:00:31,109 --> 00:00:27,840
experiments he's the principal

13
00:00:32,630 --> 00:00:31,119

investigator for the npl vaccine 21

14
00:00:34,950 --> 00:00:32,640
experiment and he's with the university

15
00:00:36,630 --> 00:00:34,960
of colorado dr klaus thanks so much for

16
00:00:37,750 --> 00:00:36,640
joining us oh my pleasure thanks for

17
00:00:39,190 --> 00:00:37,760
inviting me

18
00:00:41,430 --> 00:00:39,200
well why don't you tell us a little bit

19
00:00:43,270 --> 00:00:41,440
about what this experiment is

20
00:00:45,190 --> 00:00:43,280
okay first of all the the payload name

21
00:00:47,029 --> 00:00:45,200
is a little misleading it was manifested

22
00:00:49,750 --> 00:00:47,039
into this we were looking at vaccine

23
00:00:52,150 --> 00:00:49,760
development uh in recent flights uh this

24
00:00:53,670 --> 00:00:52,160
one rather than changing the the name

25
00:00:55,189 --> 00:00:53,680
we're slightly doing a different

26
00:00:56,950 --> 00:00:55,199
experiment it's looking at antibiotic

27
00:00:59,430 --> 00:00:56,960
effectiveness in space

28
00:01:01,430 --> 00:00:59,440
so not so much in developing a vaccine

29
00:01:03,110 --> 00:01:01,440
against a viral infection but and

30
00:01:05,590 --> 00:01:03,120
looking at antibiotics that would be

31
00:01:07,830 --> 00:01:05,600
used to treat bacterial infections okay

32
00:01:09,750 --> 00:01:07,840
and i think we have some some past um

33
00:01:11,270 --> 00:01:09,760
research that indicates that that they

34
00:01:12,710 --> 00:01:11,280
do work a little differently in space

35
00:01:14,149 --> 00:01:12,720
than they do here on the on the ground

36
00:01:16,390 --> 00:01:14,159
right there's a number of different

37
00:01:18,149 --> 00:01:16,400
phenomena that have been shown to occur

38
00:01:20,310 --> 00:01:18,159

starting with bacteria tend to grow

39
00:01:22,390 --> 00:01:20,320
better in general in space they they

40
00:01:24,550 --> 00:01:22,400
begin to grow a little sooner in the lag

41
00:01:26,789 --> 00:01:24,560
phase period and they reach higher final

42
00:01:28,550 --> 00:01:26,799
population densities

43
00:01:30,950 --> 00:01:28,560
other earlier studies have also shown

44
00:01:32,630 --> 00:01:30,960
that their bacteria are able to grow in

45
00:01:35,270 --> 00:01:32,640
the presence of what would normally be

46
00:01:37,990 --> 00:01:35,280
an inhibitory level of an antibiotic in

47
00:01:39,510 --> 00:01:38,000
a microgravity environment

48
00:01:40,950 --> 00:01:39,520
i'm sorry can you repeat that last part

49
00:01:42,630 --> 00:01:40,960
i didn't quite understand the last

50
00:01:44,630 --> 00:01:42,640
sentence there well normally you know

51
00:01:47,190 --> 00:01:44,640
antibiotics are used to kill the

52
00:01:49,350 --> 00:01:47,200
bacteria to treat bacterial infections

53
00:01:51,990 --> 00:01:49,360
but in a microgravity environment for a

54
00:01:53,510 --> 00:01:52,000
variety of reasons that are not yet

55
00:01:55,590 --> 00:01:53,520
fully understood

56
00:01:57,350 --> 00:01:55,600
it takes higher concentrations of the

57
00:02:00,149 --> 00:01:57,360
antibiotic in order to inhibit the

58
00:02:02,230 --> 00:02:00,159
growth or to kill the bacteria in space

59
00:02:03,590 --> 00:02:02,240
okay that's obviously something that

60
00:02:06,230 --> 00:02:03,600
that we would be interested in learning

61
00:02:08,790 --> 00:02:06,240
more about for for a number of reasons

62
00:02:10,150 --> 00:02:08,800
yes correct first of all uh well first

63
00:02:12,150 --> 00:02:10,160

and foremost i guess is for the

64
00:02:13,350 --> 00:02:12,160
protection of space travelers on long

65
00:02:15,030 --> 00:02:13,360
duration flights we want to have a

66
00:02:15,830 --> 00:02:15,040
better understanding of what's going on

67
00:02:18,790 --> 00:02:15,840
there

68
00:02:21,270 --> 00:02:18,800
um but also for terrestrial applications

69
00:02:23,030 --> 00:02:21,280
uh there's a number of people in the u.s

70
00:02:25,190 --> 00:02:23,040
i think the numbers around 100 000

71
00:02:27,830 --> 00:02:25,200
americans each year

72
00:02:29,750 --> 00:02:27,840
die from bacterial resistant infections

73
00:02:32,550 --> 00:02:29,760
and this is you know a huge financial

74
00:02:34,150 --> 00:02:32,560
burden not to mention the loss of life

75
00:02:35,589 --> 00:02:34,160
and the

76
00:02:37,670 --> 00:02:35,599
the study that we're looking at is is

77
00:02:39,910 --> 00:02:37,680
trying to understand a little better of

78
00:02:41,830 --> 00:02:39,920
how the bacteria acquire these uh

79
00:02:42,630 --> 00:02:41,840
drug-resistant mechanisms in the first

80
00:02:44,630 --> 00:02:42,640
place

81
00:02:46,309 --> 00:02:44,640
by watching observing and characterizing

82
00:02:47,509 --> 00:02:46,319
how they respond to the space flight

83
00:02:48,710 --> 00:02:47,519
environment where they seem to do it

84
00:02:50,949 --> 00:02:48,720
better

85
00:02:53,910 --> 00:02:50,959
and so how do you how do you study that

86
00:02:55,110 --> 00:02:53,920
in space do you i'm assuming obviously

87
00:02:56,630 --> 00:02:55,120
we don't infect the crew with something

88
00:02:58,630 --> 00:02:56,640

and then give them the vaccine so how do

89
00:03:00,790 --> 00:02:58,640
you how do you do that great this is all

90
00:03:03,509 --> 00:03:00,800
done via our microgravity test tube

91
00:03:05,670 --> 00:03:03,519
devices that allow the crew to mix these

92
00:03:08,390 --> 00:03:05,680
cells into the antibiotic concentrations

93
00:03:10,229 --> 00:03:08,400
and we basically have it set up so that

94
00:03:12,309 --> 00:03:10,239
the bacteria are going to be introduced

95
00:03:14,149 --> 00:03:12,319
to varying concentrations from

96
00:03:15,990 --> 00:03:14,159
sub-inhibitory levels to normally

97
00:03:17,589 --> 00:03:16,000
inhibitory to

98
00:03:20,070 --> 00:03:17,599
up to several times what would normally

99
00:03:21,990 --> 00:03:20,080
kill the bacteria so the indications are

100
00:03:23,990 --> 00:03:22,000
first of all whether they grow or not in

101
00:03:25,990 --> 00:03:24,000
these presence of the higher levels of

102
00:03:28,149 --> 00:03:26,000
drug and secondly when we bring them

103
00:03:29,830 --> 00:03:28,159
back we'll be doing genetic assays to

104
00:03:31,670 --> 00:03:29,840
look to see which genes might have been

105
00:03:33,350 --> 00:03:31,680
turned on or expressed differently into

106
00:03:35,350 --> 00:03:33,360
that environment

107
00:03:37,270 --> 00:03:35,360
that sounds fascinating how did how did

108
00:03:39,110 --> 00:03:37,280
y'all come up with the idea to

109
00:03:40,869 --> 00:03:39,120
to look into this

110
00:03:43,030 --> 00:03:40,879
well again this this is built on uh

111
00:03:44,390 --> 00:03:43,040
literature studies back to those studies

112
00:03:47,110 --> 00:03:44,400
the studies in the literature that date

113
00:03:49,270 --> 00:03:47,120

back to the 1980s it seems to be you

114
00:03:50,949 --> 00:03:49,280
know a lot of hit and miss one-off

115
00:03:52,550 --> 00:03:50,959
earlier experiments that have been done

116
00:03:54,869 --> 00:03:52,560
some really interesting findings and

117
00:03:57,110 --> 00:03:54,879
then for different reasons not followed

118
00:03:59,509 --> 00:03:57,120
up on so we've been uh we've been

119
00:04:01,670 --> 00:03:59,519
conducting research with bacteria for

120
00:04:02,949 --> 00:04:01,680
roughly 20 years now and under various

121
00:04:05,030 --> 00:04:02,959
space missions and different

122
00:04:06,710 --> 00:04:05,040
applications and this is just the next

123
00:04:08,470 --> 00:04:06,720
extension where we're really excited to

124
00:04:10,710 --> 00:04:08,480
see this particular one fly i am

125
00:04:12,550 --> 00:04:10,720
particularly excited to see this one

126
00:04:14,390 --> 00:04:12,560
coming to fruition i'm really anxious to

127
00:04:16,789 --> 00:04:14,400
see what the results show

128
00:04:20,229 --> 00:04:16,799
how long before you would have results

129
00:04:22,230 --> 00:04:20,239
is it is there a lag time to study the

130
00:04:23,670 --> 00:04:22,240
study what you get down the data

131
00:04:25,590 --> 00:04:23,680
before you were able to say anything

132
00:04:27,270 --> 00:04:25,600
conclusive yeah in our case you know

133
00:04:29,110 --> 00:04:27,280
we're going up on orbital one with this

134
00:04:30,790 --> 00:04:29,120
then we're coming back on a couple of

135
00:04:32,950 --> 00:04:30,800
different spacex flights so part of the

136
00:04:34,550 --> 00:04:32,960
payload is coming back on on the i

137
00:04:36,230 --> 00:04:34,560
believe the spacex three and then the

138
00:04:38,629 --> 00:04:36,240

next one spacex four if i recall

139
00:04:40,390 --> 00:04:38,639
correctly so once we get the samples

140
00:04:42,550 --> 00:04:40,400
back they'll be preserved in flight

141
00:04:44,230 --> 00:04:42,560
basically the crew will go in and

142
00:04:46,710 --> 00:04:44,240
activate the experiments and then

143
00:04:48,390 --> 00:04:46,720
terminate them for a timeline and then

144
00:04:49,830 --> 00:04:48,400
they're sitting there and just in stasis

145
00:04:51,510 --> 00:04:49,840
for the rest of the period waiting for

146
00:04:52,950 --> 00:04:51,520
the return flight once we get them back

147
00:04:54,790 --> 00:04:52,960
we'll be able to begin doing the data

148
00:04:58,790 --> 00:04:54,800
analysis

149
00:05:00,950 --> 00:04:58,800
do you have um any previous um

150
00:05:03,270 --> 00:05:00,960
conclusions have you been able to

151
00:05:05,670 --> 00:05:03,280
to draw on on why

152
00:05:06,950 --> 00:05:05,680
the space atmosphere affects vaccines

153
00:05:09,029 --> 00:05:06,960
like it does

154
00:05:10,950 --> 00:05:09,039
well the the interesting thing here is

155
00:05:13,350 --> 00:05:10,960
is whether or not it's unique to that

156
00:05:15,749 --> 00:05:13,360
environment like a localized effect and

157
00:05:17,670 --> 00:05:15,759
what happens in microgravity you know

158
00:05:20,150 --> 00:05:17,680
the bacteria normally are in a

159
00:05:22,710 --> 00:05:20,160
suspension in a fluid and they're slowly

160
00:05:24,950 --> 00:05:22,720
falling due to gravity and on earth when

161
00:05:27,350 --> 00:05:24,960
you take gravity away they tend to stay

162
00:05:28,870 --> 00:05:27,360
in the same place in in the microgravity

163
00:05:31,270 --> 00:05:28,880

uh environment

164
00:05:33,430 --> 00:05:31,280
and that changes the the chemical makeup

165
00:05:34,469 --> 00:05:33,440
of what's uh in their surrounding

166
00:05:36,150 --> 00:05:34,479
environment

167
00:05:39,189 --> 00:05:36,160
it's it's you know the technical term is

168
00:05:41,830 --> 00:05:39,199
reduced mass transport essentially the

169
00:05:44,070 --> 00:05:41,840
the it's often referred to as the cells

170
00:05:45,990 --> 00:05:44,080
end up living in their dirty bath water

171
00:05:48,070 --> 00:05:46,000
uh because molecules aren't moving away

172
00:05:49,909 --> 00:05:48,080
as quickly the cells not falling away

173
00:05:51,670 --> 00:05:49,919
from the excreted products and stuff is

174
00:05:53,749 --> 00:05:51,680
not getting into the cell as quickly

175
00:05:55,189 --> 00:05:53,759
from the outside wow that's that's

176
00:05:57,029 --> 00:05:55,199
really interesting

177
00:05:59,350 --> 00:05:57,039
so it must be nice to have the space

178
00:06:01,590 --> 00:05:59,360
station around to perform this sort of

179
00:06:03,029 --> 00:06:01,600
experiment on oh absolutely i wish we

180
00:06:05,110 --> 00:06:03,039
could be up there doing this ourselves

181
00:06:06,710 --> 00:06:05,120
it'd be even it'd be even better

182
00:06:08,309 --> 00:06:06,720
but it's going to be great to have the

183
00:06:10,070 --> 00:06:08,319
data come back

184
00:06:12,070 --> 00:06:10,080
and we're really anxious to see you know

185
00:06:13,830 --> 00:06:12,080
if first of all if the cells are able to

186
00:06:15,830 --> 00:06:13,840
grow as we expect they will in these

187
00:06:17,270 --> 00:06:15,840
levels of the drug and then secondly

188
00:06:19,029 --> 00:06:17,280

when we start looking at the genes that

189
00:06:21,189 --> 00:06:19,039
are responsible for how they're able to

190
00:06:23,430 --> 00:06:21,199
do that those are those are the two

191
00:06:25,590 --> 00:06:23,440
primary results that we're looking for

192
00:06:27,590 --> 00:06:25,600
for this first round of experiments

193
00:06:29,189 --> 00:06:27,600
well that's that's great we really look

194
00:06:30,870 --> 00:06:29,199
forward to hearing what you find out and