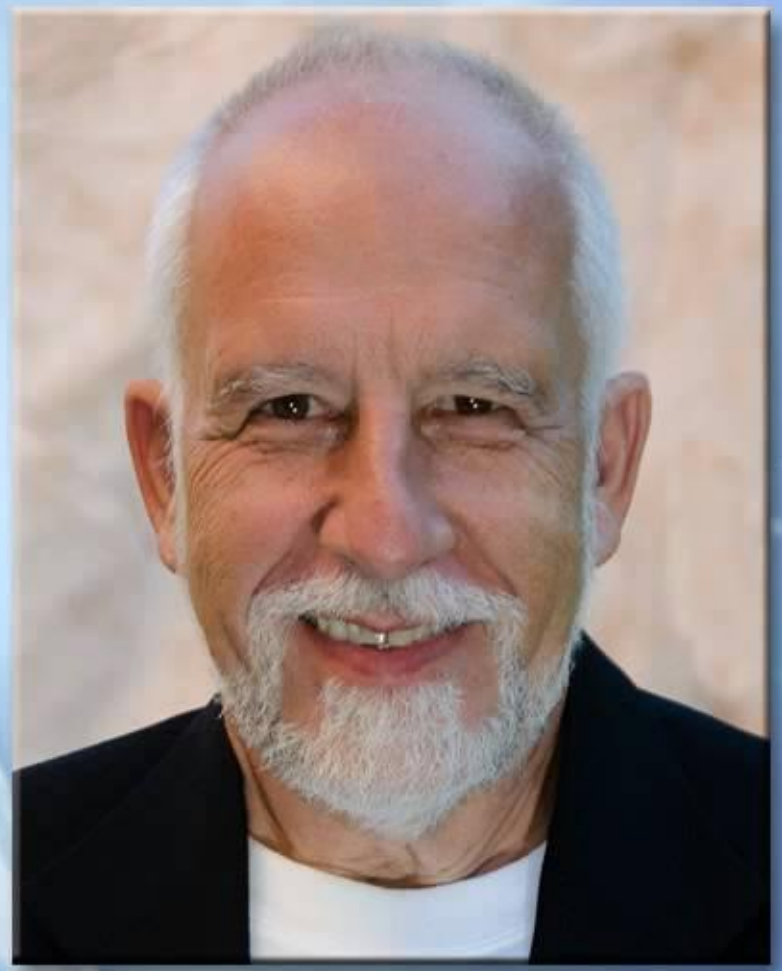

DR. KARL HASENSTEIN
PRINCIPAL INVESTIGATOR,
BIOTUBE-MICRO
UNIVERSITY OF LOUISIANA
AT LAFAYETTE

1
00:00:06,070 --> 00:00:04,230
the dragon cargo ship which arrived at

2
00:00:08,950 --> 00:00:06,080
the station late last month

3
00:00:12,070 --> 00:00:08,960
carried opals and another large payload

4
00:00:14,070 --> 00:00:12,080
in its unpressurized section its trunk

5
00:00:17,029 --> 00:00:14,080
it also carried

6
00:00:19,189 --> 00:00:17,039
many many other science payloads inside

7
00:00:20,870 --> 00:00:19,199
the freight carrier a number of new

8
00:00:23,670 --> 00:00:20,880
experiments that have come to space

9
00:00:25,509 --> 00:00:23,680
designed to take advantage of the low

10
00:00:27,349 --> 00:00:25,519
earth orbit environment

11
00:00:30,470 --> 00:00:27,359
one of these new experiments is called

12
00:00:33,990 --> 00:00:30,480
biotube micro and it's focused on how

13
00:00:35,830 --> 00:00:34,000

plants sense and respond to gravity the

14
00:00:37,750 --> 00:00:35,840
principal investigator dr carl

15
00:00:39,190 --> 00:00:37,760
hasenstein joins us this morning from

16
00:00:42,310 --> 00:00:39,200
his office at the university of

17
00:00:44,229 --> 00:00:42,320
louisiana at lafayette dr hastenstein

18
00:00:46,310 --> 00:00:44,239
people have been looking at how plants

19
00:00:48,790 --> 00:00:46,320
do in space for a long time

20
00:00:49,750 --> 00:00:48,800
generally how do they do

21
00:00:55,110 --> 00:00:49,760
well

22
00:00:57,590 --> 00:00:55,120
especially once they get exposed to the

23
00:00:58,549 --> 00:00:57,600
proper environment initially we did not

24
00:01:00,389 --> 00:00:58,559
know

25
00:01:02,470 --> 00:01:00,399
what it means to grow

26
00:01:05,750 --> 00:01:02,480
plants in the absence of gravity but it

27
00:01:08,870 --> 00:01:05,760
turns out it wasn't gravity that was the

28
00:01:11,109 --> 00:01:08,880
corporate in not succeeding

29
00:01:13,030 --> 00:01:11,119
with plant growth it was the lack of

30
00:01:15,830 --> 00:01:13,040
convection and as a result the

31
00:01:18,469 --> 00:01:15,840
distribution of gases and so forth that

32
00:01:21,270 --> 00:01:18,479
prevented proper development but we have

33
00:01:23,350 --> 00:01:21,280
come a long way and learned how to do it

34
00:01:25,510 --> 00:01:23,360
in the meantime so we can grow

35
00:01:27,350 --> 00:01:25,520
plants quite well

36
00:01:29,749 --> 00:01:27,360
the gravity is still a factor right what

37
00:01:31,030 --> 00:01:29,759
what caused you to to be focused on that

38
00:01:31,990 --> 00:01:31,040

aspect

39
00:01:34,069 --> 00:01:32,000
well

40
00:01:37,109 --> 00:01:34,079
it's a conundrum for more than a hundred

41
00:01:39,749 --> 00:01:37,119
years to find out why every tree

42
00:01:41,990 --> 00:01:39,759
grows upright and

43
00:01:45,109 --> 00:01:42,000
anchors itself in the soil

44
00:01:49,510 --> 00:01:45,119
and this basic question as to how

45
00:01:51,749 --> 00:01:49,520
tiny cells that don't have specialized

46
00:01:54,870 --> 00:01:51,759
features such as we have in our

47
00:01:58,149 --> 00:01:54,880
vestibular apparatus are able to sense

48
00:02:00,630 --> 00:01:58,159
and respond to gravity is just puzzling

49
00:02:04,069 --> 00:02:00,640
and one of the aspects of

50
00:02:06,389 --> 00:02:04,079
detecting how these things work

51
00:02:09,190 --> 00:02:06,399
ideally requires to

52
00:02:10,630 --> 00:02:09,200
remove gravity as a factor and this way

53
00:02:13,030 --> 00:02:10,640
we can

54
00:02:16,150 --> 00:02:13,040
gradually test how individual components

55
00:02:20,229 --> 00:02:16,160
of this system that makes plants sense

56
00:02:25,670 --> 00:02:22,550
respond to gravity and that's what this

57
00:02:27,589 --> 00:02:25,680
experiment is about okay uh take us

58
00:02:29,110 --> 00:02:27,599
through your plan then what are you

59
00:02:30,309 --> 00:02:29,120
going to be what have you sent to space

60
00:02:33,030 --> 00:02:30,319
and what are you going to be doing in

61
00:02:34,150 --> 00:02:33,040
that hardware on orbit

62
00:02:37,990 --> 00:02:34,160
well

63
00:02:39,830 --> 00:02:38,000

the biotube micro is an external

64
00:02:41,190 --> 00:02:39,840
shell that contains the actual

65
00:02:42,229 --> 00:02:41,200
experiment

66
00:02:44,390 --> 00:02:42,239
and

67
00:02:45,830 --> 00:02:44,400
the actual experiment consists of

68
00:02:47,750 --> 00:02:45,840
so-called

69
00:02:49,190 --> 00:02:47,760
magnetic

70
00:02:54,630 --> 00:02:49,200
chambers

71
00:02:57,270 --> 00:02:54,640
series of exactly 10

72
00:02:59,430 --> 00:02:57,280
magnets that are aligned so that they

73
00:03:01,430 --> 00:02:59,440
generate a very strong

74
00:03:04,550 --> 00:03:01,440
magnetic field

75
00:03:07,830 --> 00:03:04,560
inside this field we distort this

76
00:03:09,509 --> 00:03:07,840
uniform magnetic field by

77
00:03:13,509 --> 00:03:09,519
you could call it

78
00:03:15,910 --> 00:03:13,519
magnetic lenses there in reality

79
00:03:17,830 --> 00:03:15,920
ferromagnetic wedges

80
00:03:20,790 --> 00:03:17,840
and what does that have to do with how

81
00:03:23,589 --> 00:03:20,800
plants respond to gravity these magnetic

82
00:03:27,430 --> 00:03:23,599
gradients that result by inserting these

83
00:03:30,550 --> 00:03:27,440
wedges into the uniform magnetic field

84
00:03:31,750 --> 00:03:30,560
exert what we call a magnetophoretic

85
00:03:34,869 --> 00:03:31,760
force

86
00:03:38,630 --> 00:03:34,879
is specific

87
00:03:41,110 --> 00:03:38,640
for diamagnetic compounds such as the

88
00:03:43,589 --> 00:03:41,120

middle class that are the suspected

89
00:03:46,470 --> 00:03:43,599
gravity sensors it sounds like you're

90
00:03:49,190 --> 00:03:46,480
you're manipulating the gravity pull

91
00:03:51,990 --> 00:03:49,200
on on on these parts of the plant

92
00:03:54,710 --> 00:03:52,000
that's correct but we don't exert a pull

93
00:03:56,869 --> 00:03:54,720
we exert a push

94
00:03:58,789 --> 00:03:56,879
these high graded magnetic fields repel

95
00:04:00,630 --> 00:03:58,799
the starch

96
00:04:02,789 --> 00:04:00,640
filled the miloplasts

97
00:04:03,670 --> 00:04:02,799
and by doing so

98
00:04:06,149 --> 00:04:03,680
they

99
00:04:08,470 --> 00:04:06,159
produce the same effect that we see

100
00:04:11,350 --> 00:04:08,480
under the influence of gravity

101
00:04:14,550 --> 00:04:11,360
without having any other

102
00:04:16,629 --> 00:04:14,560
cellular component exposed to gravity so

103
00:04:17,909 --> 00:04:16,639
we can pinpoint whether the milloplast

104
00:04:19,349 --> 00:04:17,919
is actually

105
00:04:21,430 --> 00:04:19,359
doing

106
00:04:23,350 --> 00:04:21,440
the the initiation

107
00:04:27,510 --> 00:04:23,360
of the sensing and

108
00:04:31,189 --> 00:04:27,520
responds to gravity by virtue of

109
00:04:33,590 --> 00:04:31,199
moving them around in their respective

110
00:04:35,909 --> 00:04:33,600
cells we call them static sites very

111
00:04:38,790 --> 00:04:35,919
interesting do the do the crew members

112
00:04:41,350 --> 00:04:38,800
participate in this in some way

113
00:04:42,629 --> 00:04:41,360

not really they were

114
00:04:44,710 --> 00:04:42,639
helpful in

115
00:04:47,990 --> 00:04:44,720
stowing the the hardware into the

116
00:04:49,909 --> 00:04:48,000
express rack on iss but the actual

117
00:04:52,790 --> 00:04:49,919
experiment is

118
00:04:55,749 --> 00:04:52,800
entirely controlled from ksc

119
00:04:57,030 --> 00:04:55,759
okay now i assume then that

120
00:04:59,030 --> 00:04:57,040
you've flown this on dragon you're going

121
00:05:00,469 --> 00:04:59,040
to get these samples back what do you do

122
00:05:02,390 --> 00:05:00,479
with them when you get them

123
00:05:03,590 --> 00:05:02,400
well we we will

124
00:05:04,870 --> 00:05:03,600
analyze

125
00:05:06,469 --> 00:05:04,880
different things

126
00:05:08,790 --> 00:05:06,479
one is the distribution of these

127
00:05:11,670 --> 00:05:08,800
amyloplasts

128
00:05:13,590 --> 00:05:11,680
after we have seen downlink video to

129
00:05:16,390 --> 00:05:13,600
indicate whether we obser observe

130
00:05:18,469 --> 00:05:16,400
actually curvature in the roots so we

131
00:05:20,150 --> 00:05:18,479
have a video equipment

132
00:05:22,469 --> 00:05:20,160
that takes

133
00:05:23,749 --> 00:05:22,479
pictures in the infrared region of this

134
00:05:30,469 --> 00:05:23,759
um

135
00:05:33,670 --> 00:05:30,479
come back

136
00:05:35,430 --> 00:05:33,680
we will call we will correlate the

137
00:05:37,430 --> 00:05:35,440
distribution of

138
00:05:40,390 --> 00:05:37,440

the middle class within these status

139
00:05:42,310 --> 00:05:40,400
sides to the observed curvature and we

140
00:05:45,590 --> 00:05:42,320
will also

141
00:05:48,469 --> 00:05:45,600
do a series of genetic tests to see if

142
00:05:49,670 --> 00:05:48,479
gene expression has changed

143
00:05:52,629 --> 00:05:49,680
in the

144
00:05:56,029 --> 00:05:52,639
growth conditions that we had in space

145
00:05:58,150 --> 00:05:56,039
at the same time we do so called

146
00:06:00,309 --> 00:05:58,160
immunocytolocalization of relevant

147
00:06:01,909 --> 00:06:00,319
proteins that are responsible for the

148
00:06:03,909 --> 00:06:01,919
growth response of

149
00:06:05,749 --> 00:06:03,919
cells and or roots in general so there's

150
00:06:07,350 --> 00:06:05,759
still plenty of study to be done once

151
00:06:09,510 --> 00:06:07,360
you get the samples back

152
00:06:11,830 --> 00:06:09,520
yes indeed now i found it very

153
00:06:13,990 --> 00:06:11,840
interesting that i saw that you ran this

154
00:06:15,830 --> 00:06:14,000
experience experiment on the last flight

155
00:06:17,830 --> 00:06:15,840
of columbia and we're still able to get

156
00:06:20,790 --> 00:06:17,840
some results back from downlinked images

157
00:06:22,950 --> 00:06:20,800
right yeah that's correct um it it was

158
00:06:25,270 --> 00:06:22,960
unfortunate that we could not get our

159
00:06:28,469 --> 00:06:25,280
biological material back

160
00:06:31,749 --> 00:06:28,479
but the downlink suggested strongly that

161
00:06:33,590 --> 00:06:31,759
we had curvature as we had expected but

162
00:06:36,230 --> 00:06:33,600
we were not able to confirm this because

163
00:06:39,510 --> 00:06:36,240

we never received the actual

164
00:06:41,430 --> 00:06:39,520
plant material is your goal to simply

165
00:06:43,830 --> 00:06:41,440
improve the way plants grow in space or

166
00:06:44,710 --> 00:06:43,840
does this have applicability on earth

167
00:06:46,870 --> 00:06:44,720
well

168
00:06:49,909 --> 00:06:46,880
any time you have

169
00:06:51,029 --> 00:06:49,919
better or deeper understanding as to how

170
00:06:53,189 --> 00:06:51,039
plants

171
00:06:55,830 --> 00:06:53,199
perform and respond to

172
00:06:57,510 --> 00:06:55,840
environmental cues or problems

173
00:07:00,309 --> 00:06:57,520
you are bound to

174
00:07:01,270 --> 00:07:00,319
benefit processes on earth as well

175
00:07:04,309 --> 00:07:01,280
so

176
00:07:07,110 --> 00:07:04,319
while we clearly want to

177
00:07:09,909 --> 00:07:07,120
establish a means of directionally

178
00:07:11,589 --> 00:07:09,919
controlling plant growth in space we

179
00:07:15,270 --> 00:07:11,599
also

180
00:07:18,629 --> 00:07:15,280
want to use that gained knowledge for

181
00:07:20,870 --> 00:07:18,639
improvement of plants on on earth

182
00:07:22,309 --> 00:07:20,880
dr hazenstein thank you for taking a few

183
00:07:24,150 --> 00:07:22,319
minutes for us this morning and good

184
00:07:26,390 --> 00:07:24,160
luck with the experiment thank you so