
AB
GRAD
CON23

1
00:00:04,230 --> 00:00:10,990
[Music]

2
00:00:17,870 --> 00:00:14,709
hi everyone I'm

3
00:00:19,010 --> 00:00:17,880
from Ohio University I'm a space

4
00:00:25,849 --> 00:00:19,020
biologist

5
00:00:28,250 --> 00:00:25,859
that we send plant samples to space

6
00:00:30,050 --> 00:00:28,260
and I will try to see how those plant

7
00:00:32,450 --> 00:00:30,060
samples adapt to the space flight

8
00:00:37,190 --> 00:00:32,460
environment and then we use information

9
00:00:40,250 --> 00:00:37,200
from these to make them better adapt to

10
00:00:43,549 --> 00:00:40,260
a stream environment on heart or to also

11
00:00:46,150 --> 00:00:43,559
prepare how we can cultivate uh plants

12
00:00:49,310 --> 00:00:46,160
in space for future

13
00:00:52,790 --> 00:00:49,320

cultivations future exploration

14
00:00:55,729 --> 00:00:52,800
and so I work on arabidopsis plants

15
00:00:59,330 --> 00:00:55,739
which is a model plant it's what E coli

16
00:01:02,810 --> 00:00:59,340
is to microbiologists and um it's model

17
00:01:06,170 --> 00:01:02,820
because it's a also the genome sequenced

18
00:01:08,870 --> 00:01:06,180
already and so we can easily trace a

19
00:01:12,830 --> 00:01:08,880
particular phenotype to a particular

20
00:01:15,649 --> 00:01:12,840
genotype so to the right up there is

21
00:01:18,649 --> 00:01:15,659
what the arabidosis siblings look like

22
00:01:21,950 --> 00:01:18,659
after we get them back from the space

23
00:01:25,609 --> 00:01:21,960
environment in this case I mean about

24
00:01:28,670 --> 00:01:25,619
about the International Space Station at

25
00:01:31,310 --> 00:01:28,680
the lower Hutt orbit where we have zero

26
00:01:34,190 --> 00:01:31,320
gravity microgravity and that way we

27
00:01:36,649 --> 00:01:34,200
have ionizing radiation and altered flue

28
00:01:39,890 --> 00:01:36,659
gas Dynamics as one of the extremities

29
00:01:42,530 --> 00:01:39,900
in that environment so basically we send

30
00:01:44,630 --> 00:01:42,540
seed to space we let those seeds

31
00:01:47,090 --> 00:01:44,640
germinate in space we let them grow for

32
00:01:49,370 --> 00:01:47,100
few days we freeze them and we return

33
00:01:51,609 --> 00:01:49,380
them to Earth and when they get part of

34
00:01:54,950 --> 00:01:51,619
half I analyze them

35
00:01:58,490 --> 00:01:54,960
transcriptomics and proteomics to make

36
00:02:00,850 --> 00:01:58,500
uh to make sense of how such plants

37
00:02:04,069 --> 00:02:00,860
adapts to the space flight environment

38
00:02:06,289 --> 00:02:04,079

and for uh us to conduct specified

39
00:02:10,070 --> 00:02:06,299
environments we use different Hardwares

40
00:02:12,770 --> 00:02:10,080
as you can see on top

41
00:02:14,869 --> 00:02:12,780
on top Air is the advanced plant habitat

42
00:02:17,110 --> 00:02:14,879
that's the desired most desirable

43
00:02:20,869 --> 00:02:17,120
Hardware currently for almost everyone

44
00:02:22,850 --> 00:02:20,879
researching uh space plant biology and

45
00:02:25,369 --> 00:02:22,860
here we have the brick

46
00:02:27,110 --> 00:02:25,379
break Hardware I love using the brick

47
00:02:29,330 --> 00:02:27,120
it's got the name from the fact that it

48
00:02:31,970 --> 00:02:29,340
looks like a brick Block it's biological

49
00:02:34,190 --> 00:02:31,980
research in canister I work with it and

50
00:02:36,949 --> 00:02:34,200
this is the European modular cultivation

51
00:02:38,949 --> 00:02:36,959
system it's been retired currently and

52
00:02:43,070 --> 00:02:38,959
being replaced by the multivariable

53
00:02:44,809 --> 00:02:43,080
platform so these are just a few of the

54
00:02:47,750 --> 00:02:44,819
many Hardwares that we used to send

55
00:02:50,449 --> 00:02:47,760
specimen to space plants micro but in

56
00:02:53,869 --> 00:02:50,459
this case we we use this to stand out

57
00:02:57,770 --> 00:02:53,879
plant to space

58
00:03:00,050 --> 00:02:57,780
uh the first multi-homix are experiments

59
00:03:02,330 --> 00:03:00,060
conducted on plant Central space was

60
00:03:05,509 --> 00:03:02,340
conducted by my lab and then we

61
00:03:08,150 --> 00:03:05,519
discovered that uh comparing the look

62
00:03:10,430 --> 00:03:08,160
for change of the transcript that's the

63
00:03:13,250 --> 00:03:10,440

RNA to the look for change of the

64
00:03:15,710 --> 00:03:13,260
protein while plotting a correlation

65
00:03:17,930 --> 00:03:15,720
graph of it we discovered very low

66
00:03:19,970 --> 00:03:17,940
correlation between differentially

67
00:03:22,670 --> 00:03:19,980
expressed transcript and differentially

68
00:03:25,430 --> 00:03:22,680
abundant protein which is uh indicative

69
00:03:28,850 --> 00:03:25,440
of the fact that post-transcriptional

70
00:03:31,309 --> 00:03:28,860
modification of transcript is one of the

71
00:03:34,729 --> 00:03:31,319
Adaptive mechanism of plants to space

72
00:03:39,050 --> 00:03:34,739
flight environment that means not all

73
00:03:42,050 --> 00:03:39,060
RNA gets to become protein and that also

74
00:03:44,390 --> 00:03:42,060
net it's it's underscore the need for us

75
00:03:46,490 --> 00:03:44,400
to study procurements to conduct

76
00:03:48,830 --> 00:03:46,500
proteomic studies of these plants that

77
00:03:51,289 --> 00:03:48,840
we send to space because the proteomies

78
00:03:53,030 --> 00:03:51,299
will probably give more insight into the

79
00:03:56,330 --> 00:03:53,040
Adaptive mechanism than the

80
00:03:59,710 --> 00:03:56,340
transcriptomics unfortunately because

81
00:04:02,630 --> 00:03:59,720
protonic study require large tissue Mass

82
00:04:04,869 --> 00:04:02,640
which we don't have the luxury of having

83
00:04:08,149 --> 00:04:04,879
large tissue large plants sent to space

84
00:04:11,570 --> 00:04:08,159
most people conduct just transcriptomic

85
00:04:14,809 --> 00:04:11,580
study until date globally only for

86
00:04:18,409 --> 00:04:14,819
protonic study have been conducted on

87
00:04:21,289 --> 00:04:18,419
arabidosis and above ISS and these are

88
00:04:24,170 --> 00:04:21,299

the four protonic studies uh different

89
00:04:26,749 --> 00:04:24,180
environments are different uh conditions

90
00:04:30,290 --> 00:04:26,759
different variables uh age of the plants

91
00:04:33,230 --> 00:04:30,300
out where uh light condition seed line

92
00:04:36,170 --> 00:04:33,240
used the tissue type and the type of

93
00:04:39,710 --> 00:04:36,180
protein extracted they vary across all

94
00:04:41,390 --> 00:04:39,720
those uh four experiments two of those

95
00:04:43,249 --> 00:04:41,400
experiments were conducted on the lab

96
00:04:46,610 --> 00:04:43,259
I'm the one in charge of the last one in

97
00:04:51,710 --> 00:04:46,620
red called The Brick LED uh project so

98
00:04:54,170 --> 00:04:51,720
to get idea of um what's uh the uh to

99
00:04:55,969 --> 00:04:54,180
get idea of plants response on the the

100
00:04:58,070 --> 00:04:55,979
protonic level to the space flight

101
00:05:00,189 --> 00:04:58,080
environment based on these are field

102
00:05:02,749 --> 00:05:00,199
data set we have to do what we call

103
00:05:05,330 --> 00:05:02,759
meta-analysis of the protonic data set

104
00:05:07,850 --> 00:05:05,340
from this of the protonic data sets from

105
00:05:10,070 --> 00:05:07,860
these four experiment and that's what I

106
00:05:10,990 --> 00:05:10,080
do so this is the first stage of the

107
00:05:14,590 --> 00:05:11,000
metal

108
00:05:18,710 --> 00:05:14,600
analysis so we start from the left ear

109
00:05:21,710 --> 00:05:18,720
are we intersected the protein

110
00:05:24,590 --> 00:05:21,720
um abundance about the detected protein

111
00:05:26,930 --> 00:05:24,600
across all the four Hardwares and common

112
00:05:29,930 --> 00:05:26,940
to the protein across all the four

113
00:05:32,390 --> 00:05:29,940

Hardware these are three protein

114
00:05:34,730 --> 00:05:32,400
which are pick up one that's the

115
00:05:36,830 --> 00:05:34,740
microtubule destabilizing protein which

116
00:05:39,830 --> 00:05:36,840
is involved in chromosome separation

117
00:05:42,469 --> 00:05:39,840
during cell division it involves

118
00:05:44,570 --> 00:05:42,479
information of um cell shape and it's

119
00:05:47,330 --> 00:05:44,580
also involved in a transport vesicular

120
00:05:49,010 --> 00:05:47,340
transport implant and also we we

121
00:05:51,830 --> 00:05:49,020
discovered the comment of these four

122
00:05:54,050 --> 00:05:51,840
four data sets our protein is that the

123
00:05:59,150 --> 00:05:54,060
protein involving defense response and

124
00:06:03,409 --> 00:05:59,160
mRNA binding now I went a step further

125
00:06:06,230 --> 00:06:03,419
and isolated uh the data set called emcs

126
00:06:08,870 --> 00:06:06,240
which is the the data set called abrs

127
00:06:10,430 --> 00:06:08,880
Advanced biological research system I

128
00:06:12,950 --> 00:06:10,440
isolated it

129
00:06:16,070 --> 00:06:12,960
from the data from the general data set

130
00:06:19,490 --> 00:06:16,080
because it uh they use the mutant seed

131
00:06:22,309 --> 00:06:19,500
line so I I only call I compared those

132
00:06:25,490 --> 00:06:22,319
seed lines that were the wide type and

133
00:06:27,650 --> 00:06:25,500
from intersection of the three data set

134
00:06:29,990 --> 00:06:27,660
that com that you know that use our seed

135
00:06:33,110 --> 00:06:30,000
lines that are white type we have these

136
00:06:35,210 --> 00:06:33,120
eight proteins and here are the air the

137
00:06:38,330 --> 00:06:35,220
proteins so conducting the protein

138
00:06:41,809 --> 00:06:38,340

protein uh interaction network analysis

139
00:06:43,790 --> 00:06:41,819
we see that regulation of microtubule

140
00:06:46,550 --> 00:06:43,800
microtubule destabilization or

141
00:06:50,570 --> 00:06:46,560
microtubule rearrangement is a major

142
00:06:53,510 --> 00:06:50,580
adaptation uh mechanism of plants to the

143
00:06:56,210 --> 00:06:53,520
extreme space flight environment and one

144
00:06:58,370 --> 00:06:56,220
thing we notice in phenotype of plants

145
00:07:01,309 --> 00:06:58,380
that we grow in space is that they are

146
00:07:04,309 --> 00:07:01,319
usually uh smaller looking less healthy

147
00:07:06,590 --> 00:07:04,319
compared to those grown on Earth where

148
00:07:09,890 --> 00:07:06,600
we have the full gravity and there are

149
00:07:11,770 --> 00:07:09,900
no ionizing radiation now I went further

150
00:07:14,629 --> 00:07:11,780
to compare the

151
00:07:16,610 --> 00:07:14,639
brick data set which are the one that we

152
00:07:19,070 --> 00:07:16,620
conducted in our lab and we can be so

153
00:07:21,830 --> 00:07:19,080
sure of so we have two of them we have

154
00:07:24,230 --> 00:07:21,840
the brick LED which were conducted in

155
00:07:26,870 --> 00:07:24,240
light you know this brick LED Hardware

156
00:07:30,409 --> 00:07:26,880
add light in it and we have the brick

157
00:07:32,629 --> 00:07:30,419
PDF view which had no light so all these

158
00:07:35,330 --> 00:07:32,639
plants this experiment were both flown

159
00:07:37,909 --> 00:07:35,340
to space uh weapon were both flew into

160
00:07:41,150 --> 00:07:37,919
space but won't add light one add more

161
00:07:45,110 --> 00:07:41,160
light both of them had no gravity are

162
00:07:47,870 --> 00:07:45,120
they so at The Intercept of them the

163
00:07:49,249 --> 00:07:47,880

protein here 186 of them would

164
00:07:51,830 --> 00:07:49,259
definitely be due to the space flight

165
00:07:53,629 --> 00:07:51,840
environment while the protein here will

166
00:07:56,330 --> 00:07:53,639
be due to photomorphogenesis that is

167
00:07:58,610 --> 00:07:56,340
growed in light cross-interacting

168
00:08:00,950 --> 00:07:58,620
protein maybe between the hardware and

169
00:08:02,510 --> 00:08:00,960
growth and light and Elusive protein due

170
00:08:04,550 --> 00:08:02,520
to the advanced technology that we use

171
00:08:07,249 --> 00:08:04,560
on the brick LED compared to the brick

172
00:08:09,710 --> 00:08:07,259
PDF view why the protein here are those

173
00:08:12,230 --> 00:08:09,720
involved in scotomorphogenesis growth in

174
00:08:14,629 --> 00:08:12,240
darkness and cross-interacting protein

175
00:08:16,550 --> 00:08:14,639
now I call this protein due to space

176
00:08:19,309 --> 00:08:16,560
flight environment I call them the brick

177
00:08:21,610 --> 00:08:19,319
intercept so comparing the brick

178
00:08:24,770 --> 00:08:21,620
intercept this is the brick intercept

179
00:08:26,570 --> 00:08:24,780
comparing it with another data set from

180
00:08:30,469 --> 00:08:26,580
the European modular cultivation system

181
00:08:31,730 --> 00:08:30,479
where they add a centrifuge about the

182
00:08:34,490 --> 00:08:31,740
International Space Station one

183
00:08:35,630 --> 00:08:34,500
decentric food having the 1G centrifuge

184
00:08:39,050 --> 00:08:35,640
above International Space Station

185
00:08:43,670 --> 00:08:39,060
eliminates microgravity so it introduced

186
00:08:46,790 --> 00:08:43,680
1G gravity so this data set emcs

187
00:08:48,650 --> 00:08:46,800
as as excluded microgravity and

188
00:08:51,889 --> 00:08:48,660

everything in this data set is radiation

189
00:08:54,470 --> 00:08:51,899
so comparing our intersecting this brick

190
00:08:56,810 --> 00:08:54,480
intercept with this emcs data set

191
00:09:00,050 --> 00:08:56,820
whatever is in the middle here will

192
00:09:02,810 --> 00:09:00,060
definitely be due to radiation or

193
00:09:05,030 --> 00:09:02,820
altered fluid gas Dynamic you know in

194
00:09:07,550 --> 00:09:05,040
the absence of gravity plants don't pick

195
00:09:10,009 --> 00:09:07,560
water the same way that we do on Earth

196
00:09:12,410 --> 00:09:10,019
and whatever we have here is due to

197
00:09:14,389 --> 00:09:12,420
microgravity definitely and whatever we

198
00:09:17,750 --> 00:09:14,399
have here proteins here are due to the

199
00:09:20,150 --> 00:09:17,760
emcs hardware and cross interaction now

200
00:09:23,210 --> 00:09:20,160
doing a protein protein interaction a

201
00:09:25,730 --> 00:09:23,220
network of the uh proteins that we

202
00:09:28,790 --> 00:09:25,740
believe are due to radiation we see that

203
00:09:31,790 --> 00:09:28,800
ah most of them are involved in ribosome

204
00:09:34,190 --> 00:09:31,800
assembly ribosome biogenesis and um

205
00:09:37,190 --> 00:09:34,200
ribosome powerogenesis and protein

206
00:09:39,350 --> 00:09:37,200
translational Machinery so one takeaway

207
00:09:42,310 --> 00:09:39,360
from this is that arabidosis ribosomal

208
00:09:46,130 --> 00:09:42,320
activity is altered by space flight

209
00:09:47,930 --> 00:09:46,140
ionizing radiation So currently I'm I'm

210
00:09:50,509 --> 00:09:47,940
comparing the transcriptomic data

211
00:09:52,190 --> 00:09:50,519
between these two data sets and we're

212
00:09:55,070 --> 00:09:52,200
also trying to do a wet lab

213
00:09:57,470 --> 00:09:55,080

determination of the specific role of

214
00:10:00,850 --> 00:09:57,480
this intersecting protein so we're

215
00:10:03,889 --> 00:10:00,860
hoping to collaboration on a protonic

216
00:10:05,509 --> 00:10:03,899
meta-analysis of this uh space flight

217
00:10:08,570 --> 00:10:05,519
stuff there are a lot of things that

218
00:10:11,030 --> 00:10:08,580
could be done or made so uh my

219
00:10:14,389 --> 00:10:11,040
acknowledgment to Dr Sarah white that's

220
00:10:17,810 --> 00:10:14,399
my advisor and then Dr Colin Cruz from

221
00:10:20,509 --> 00:10:17,820
the National Lab in New Mexico and to

222
00:10:23,990 --> 00:10:20,519
the NASA analysis working group plant

223
00:10:30,190 --> 00:10:24,000
homies who sponsored this uh research

224
00:10:35,330 --> 00:10:32,509
[Applause]