
NASA
SPACESTATION
LIVE

1
00:00:08,310 --> 00:00:06,630
so a lot of the science being done on

2
00:00:10,310 --> 00:00:08,320
the international space station design

3
00:00:12,310 --> 00:00:10,320
to learn more about how the human body

4
00:00:14,070 --> 00:00:12,320
responds to extended periods of time in

5
00:00:15,669 --> 00:00:14,080
the weightless environment of space the

6
00:00:18,070 --> 00:00:15,679
space station crew members themselves

7
00:00:19,750 --> 00:00:18,080
serving as those test subjects one new

8
00:00:21,590 --> 00:00:19,760
experiment in this area which is

9
00:00:23,830 --> 00:00:21,600
actually sponsored by the canadian space

10
00:00:25,750 --> 00:00:23,840
agency recently got underway and it's

11
00:00:28,230 --> 00:00:25,760
called the marrow study which is

12
00:00:30,710 --> 00:00:28,240
actually looking at bone marrow in these

13
00:00:32,549 --> 00:00:30,720

astronauts recently my colleague brandi

14
00:00:35,270 --> 00:00:32,559
dean spoke with the experiments

15
00:00:36,870 --> 00:00:35,280
principal investigator dr g trudell a

16
00:00:39,350 --> 00:00:36,880
professor of medicine surgery and

17
00:00:40,389 --> 00:00:39,360
biochemistry at the university of ottawa

18
00:00:43,270 --> 00:00:40,399
and also with one of his

19
00:00:45,190 --> 00:00:43,280
co-investigators dr odette lenouville of

20
00:00:46,869 --> 00:00:45,200
the university of ottawa and asked what

21
00:00:48,069 --> 00:00:46,879
they suspect is happening to the bone

22
00:00:51,830 --> 00:00:48,079
marrow of astronauts during

23
00:00:56,150 --> 00:00:53,990
we're a group of scientists at the bone

24
00:00:58,470 --> 00:00:56,160
and joint research lab and we're

25
00:01:00,069 --> 00:00:58,480
focusing our research on the biology of

26
00:01:01,510 --> 00:01:00,079
rehabilitation

27
00:01:04,229 --> 00:01:01,520
so when

28
00:01:06,230 --> 00:01:04,239
decreased physical forces are acting on

29
00:01:08,469 --> 00:01:06,240
the bone as you describe there are

30
00:01:10,149 --> 00:01:08,479
changes on changes on the bone itself

31
00:01:11,990 --> 00:01:10,159
and the bone structure

32
00:01:14,630 --> 00:01:12,000
but we were interested in what's

33
00:01:17,590 --> 00:01:14,640
happening with the other role of the

34
00:01:20,390 --> 00:01:17,600
bone as an organ and that's really the

35
00:01:23,190 --> 00:01:20,400
role of the bone marrow inside the bone

36
00:01:25,429 --> 00:01:23,200
to form the all the blood elements the

37
00:01:27,109 --> 00:01:25,439
red blood cells the white blood cells

38
00:01:29,429 --> 00:01:27,119

and the platelets

39
00:01:31,910 --> 00:01:29,439
so in our experiments related to

40
00:01:35,190 --> 00:01:31,920
immobility removing the physical forces

41
00:01:37,749 --> 00:01:35,200
on the bone we noticed uh spectacular

42
00:01:40,710 --> 00:01:37,759
changes in the bone marrow in some model

43
00:01:41,670 --> 00:01:40,720
is in that the bone marrow shifted from

44
00:01:44,550 --> 00:01:41,680
being

45
00:01:47,109 --> 00:01:44,560
full of cells producing the red blood

46
00:01:49,749 --> 00:01:47,119
cells and the white blood cells

47
00:01:53,429 --> 00:01:49,759
to a bone marrow more filled with fat

48
00:01:56,469 --> 00:01:53,439
cells so when a fat transformation of

49
00:01:58,310 --> 00:01:56,479
the bone marrow okay so um

50
00:02:00,149 --> 00:01:58,320
if fat cells reduce blood cell

51
00:02:02,709 --> 00:02:00,159
population in bone marrow what what

52
00:02:04,789 --> 00:02:02,719
happens to the astronaut

53
00:02:08,070 --> 00:02:04,799
so if that process

54
00:02:10,710 --> 00:02:08,080
is led to its worst case scenario that

55
00:02:13,670 --> 00:02:10,720
is a bone marrow failure then you are

56
00:02:15,990 --> 00:02:13,680
unable to mount a response to produce

57
00:02:17,990 --> 00:02:16,000
the blood cells that you need

58
00:02:20,309 --> 00:02:18,000
for survival basically

59
00:02:23,589 --> 00:02:20,319
so bone is a

60
00:02:25,750 --> 00:02:23,599
rigid structure so if you have invasion

61
00:02:28,229 --> 00:02:25,760
of one of its component it's at the

62
00:02:28,949 --> 00:02:28,239
expense of the other component

63
00:02:32,229 --> 00:02:28,959

so

64
00:02:34,790 --> 00:02:32,239
what would be examples of symptoms

65
00:02:36,470 --> 00:02:34,800
happening from a bone marrow failure so

66
00:02:39,110 --> 00:02:36,480
basically the lack of production of your

67
00:02:41,830 --> 00:02:39,120
red blood cells will lead to anemia

68
00:02:45,190 --> 00:02:41,840
so a person who is anemic will be

69
00:02:48,150 --> 00:02:45,200
weaker will have less resistance less

70
00:02:50,229 --> 00:02:48,160
force less endurance which could

71
00:02:51,190 --> 00:02:50,239
compromise emission

72
00:02:53,030 --> 00:02:51,200
uh

73
00:02:54,550 --> 00:02:53,040
dysfunctioning white blood cells or a

74
00:02:57,350 --> 00:02:54,560
low number of white blood cells will

75
00:02:59,509 --> 00:02:57,360
make you more susceptible to infections

76
00:03:01,589 --> 00:02:59,519
or autoimmune diseases

77
00:03:04,309 --> 00:03:01,599
the last function of the bone marrow is

78
00:03:06,949 --> 00:03:04,319
the production of platelets and these

79
00:03:08,790 --> 00:03:06,959
are responsible to stop the bleed and to

80
00:03:09,589 --> 00:03:08,800
create a blood clot

81
00:03:12,390 --> 00:03:09,599
so

82
00:03:16,229 --> 00:03:12,400
the changes that we've measured in the

83
00:03:20,070 --> 00:03:16,239
models and in bed-ridden patients

84
00:03:23,750 --> 00:03:20,080
are showing some smaller changes in fat

85
00:03:25,670 --> 00:03:23,760
accumulation but if that were to be

86
00:03:28,470 --> 00:03:25,680
extrapolated to a longer mission in

87
00:03:30,869 --> 00:03:28,480
microgravity this could lead to

88
00:03:33,430 --> 00:03:30,879

a bone marrow failure

89
00:03:35,350 --> 00:03:33,440
i see okay well so how how does your

90
00:03:36,869 --> 00:03:35,360
investigation the mirabe investigation

91
00:03:39,110 --> 00:03:36,879
how does it um

92
00:03:40,229 --> 00:03:39,120
look at that in astronauts in particular

93
00:03:43,190 --> 00:03:40,239
so the

94
00:03:46,550 --> 00:03:43,200
protocol we've developed is to

95
00:03:47,830 --> 00:03:46,560
gather some biological samples from the

96
00:03:51,030 --> 00:03:47,840
astronauts

97
00:03:51,990 --> 00:03:51,040
pre-flight during flights and after

98
00:03:54,390 --> 00:03:52,000
flight

99
00:03:56,710 --> 00:03:54,400
and the protocols and methods that we

100
00:03:58,949 --> 00:03:56,720
developed was in collaboration with the

101
00:04:00,869 --> 00:03:58,959
canadian space agency

102
00:04:01,750 --> 00:04:00,879
in canada

103
00:04:02,550 --> 00:04:01,760
and

104
00:04:04,869 --> 00:04:02,560
with

105
00:04:07,670 --> 00:04:04,879
through a team effort we were able to

106
00:04:11,110 --> 00:04:07,680
design some sampling methods that will

107
00:04:14,789 --> 00:04:11,120
allow us to estimate or to measure how

108
00:04:16,150 --> 00:04:14,799
much fat is in the marrow and that will

109
00:04:18,870 --> 00:04:16,160
be using

110
00:04:20,629 --> 00:04:18,880
magnetic resonance imaging and coupled

111
00:04:23,510 --> 00:04:20,639
to spectroscopy

112
00:04:25,510 --> 00:04:23,520
and also to look at the blood itself

113
00:04:28,070 --> 00:04:25,520

through samples of blood

114
00:04:30,469 --> 00:04:28,080
collected over time so the sampling for

115
00:04:32,790 --> 00:04:30,479
alveolar air or breath

116
00:04:34,629 --> 00:04:32,800
will be pre-flagged during flight and

117
00:04:35,830 --> 00:04:34,639
toast flight so for this we had to

118
00:04:38,550 --> 00:04:35,840
design this

119
00:04:41,590 --> 00:04:38,560
contraption that we use for collecting

120
00:04:43,350 --> 00:04:41,600
the alveolar and not the air that is

121
00:04:44,629 --> 00:04:43,360
present in the

122
00:04:48,390 --> 00:04:44,639
airways

123
00:04:50,150 --> 00:04:48,400
and so it's a temporal study we will be

124
00:04:53,030 --> 00:04:50,160
able to

125
00:04:55,110 --> 00:04:53,040
estimate and measure the impact of

126
00:04:57,590 --> 00:04:55,120
microgravity exposure

127
00:04:59,030 --> 00:04:57,600
on the content the fat content of the

128
00:05:00,629 --> 00:04:59,040
marrow

129
00:05:03,590 --> 00:05:00,639
i think what is key

130
00:05:07,430 --> 00:05:03,600
or what is of high interest for our team

131
00:05:09,189 --> 00:05:07,440
is the post flight period and rehab

132
00:05:11,189 --> 00:05:09,199
how does the

133
00:05:14,469 --> 00:05:11,199
body and the marrow

134
00:05:17,510 --> 00:05:14,479
return to a normal state

135
00:05:19,909 --> 00:05:17,520
after flight so we will monitor those

136
00:05:24,870 --> 00:05:19,919
participants those astronauts over an

137
00:05:27,110 --> 00:05:24,880
extensive over a year post-flight and

138
00:05:29,350 --> 00:05:27,120

we are very thankful that the for those

139
00:05:30,230 --> 00:05:29,360
who already have agreed to participate

140
00:05:32,790 --> 00:05:30,240
and

141
00:05:33,830 --> 00:05:32,800
those who will in future participate in

142
00:05:36,150 --> 00:05:33,840
marrow

143
00:05:37,909 --> 00:05:36,160
while on board at the iss how do you

144
00:05:39,430 --> 00:05:37,919
expect that this experiment is going to

145
00:05:41,990 --> 00:05:39,440
help us as we're going forward in future

146
00:05:45,510 --> 00:05:42,000
exploration

147
00:05:47,189 --> 00:05:45,520
as you alluded to earlier this will have

148
00:05:49,350 --> 00:05:47,199
implications for astronauts on

149
00:05:51,029 --> 00:05:49,360
long-duration flights and upon their

150
00:05:53,510 --> 00:05:51,039
return

151
00:05:55,510 --> 00:05:53,520
for example

152
00:05:57,350 --> 00:05:55,520
we want we will evaluate if the

153
00:06:01,350 --> 00:05:57,360
phenomenon happens

154
00:06:04,870 --> 00:06:02,790
it will allow to

155
00:06:06,950 --> 00:06:04,880
develop counter measures

156
00:06:10,070 --> 00:06:06,960
what could prevent this

157
00:06:12,150 --> 00:06:10,080
fat accumulation in the bone marrow

158
00:06:13,029 --> 00:06:12,160
how fast is the progress

159
00:06:17,990 --> 00:06:13,039
and

160
00:06:21,990 --> 00:06:18,000
white blood cell production

161
00:06:27,189 --> 00:06:24,390
brought on board long duration missions

162
00:06:28,710 --> 00:06:27,199
such as the duration to mars that can be

163
00:06:31,590 --> 00:06:28,720

physical countermeasure could be

164
00:06:33,670 --> 00:06:31,600
pharmacological countermeasures as well

165
00:06:35,110 --> 00:06:33,680
and i know you also mentioned that um

166
00:06:37,270 --> 00:06:35,120
you were working with bed rest patients

167
00:06:38,550 --> 00:06:37,280
as well so are there are there

168
00:06:40,150 --> 00:06:38,560
implications to this that could help

169
00:06:42,790 --> 00:06:40,160
them in the future or any of us here on

170
00:06:46,710 --> 00:06:44,309
you're talking to a rehabilitation

171
00:06:49,350 --> 00:06:46,720
physician so this is really the angle

172
00:06:50,710 --> 00:06:49,360
that we have taken to approach this

173
00:06:53,029 --> 00:06:50,720
topic

174
00:06:55,350 --> 00:06:53,039
when you receive

175
00:06:57,589 --> 00:06:55,360
in a rehabilitation center

176
00:07:00,150 --> 00:06:57,599
patients who have been in hospital for a

177
00:07:01,830 --> 00:07:00,160
long time who are deconditioned and you

178
00:07:05,270 --> 00:07:01,840
need to bring them back to their

179
00:07:07,189 --> 00:07:05,280
previous level of health and of function

180
00:07:08,710 --> 00:07:07,199
then you have to look at the restoration

181
00:07:11,350 --> 00:07:08,720
of every system

182
00:07:13,430 --> 00:07:11,360
of those there is the bone system muscle

183
00:07:16,150 --> 00:07:13,440
system balance

184
00:07:17,670 --> 00:07:16,160
so when an astronauts come back from a

185
00:07:19,670 --> 00:07:17,680
long-term mission

186
00:07:22,790 --> 00:07:19,680
he presents many of the same

187
00:07:24,870 --> 00:07:22,800
characteristics as a rehab patient on

188
00:07:26,390 --> 00:07:24,880

earth who has been immobile for a long

189
00:07:29,830 --> 00:07:26,400
period of time

190
00:07:32,230 --> 00:07:29,840
now specifically for merrell

191
00:07:33,430 --> 00:07:32,240
many of those patients who have limited

192
00:07:35,670 --> 00:07:33,440
mobility

193
00:07:38,550 --> 00:07:35,680
who have been in bed for a long time or

194
00:07:40,950 --> 00:07:38,560
even in our western societies the

195
00:07:43,189 --> 00:07:40,960
sedentary lifestyle or the change in

196
00:07:44,469 --> 00:07:43,199
demographics where people move less and

197
00:07:47,589 --> 00:07:44,479
less

198
00:07:50,710 --> 00:07:47,599
we do notice higher proportion of anemia

199
00:07:53,029 --> 00:07:50,720
more susceptibility to infection so

200
00:07:53,990 --> 00:07:53,039
our findings could apply to the large

201
00:07:55,270 --> 00:07:54,000
number

202
00:07:56,950 --> 00:07:55,280
on thirst

203
00:07:59,029 --> 00:07:56,960
that's definitely good news for us and

204
00:08:01,029 --> 00:07:59,039
the astronauts then we really appreciate

205
00:08:04,550 --> 00:08:01,039
you talking with us again this was dr

206
00:08:06,390 --> 00:08:04,560
gee trudeau and dr odette newfield from

207
00:08:07,749 --> 00:08:06,400
the university of ottawa talking to us

208
00:08:09,909 --> 00:08:07,759
about their work with the marrow