
NASA
SPACESTATION
LIVE

1
00:00:08,470 --> 00:00:07,030
so a ton of human research experiments

2
00:00:09,990 --> 00:00:08,480
take place onboard the international

3
00:00:11,270 --> 00:00:10,000
space station because a lot happens to

4
00:00:13,430 --> 00:00:11,280
the human body when you're in

5
00:00:15,509 --> 00:00:13,440
microgravity i'm joined now by one of

6
00:00:17,510 --> 00:00:15,519
the principal investigators for one such

7
00:00:20,310 --> 00:00:17,520
research study dr stephen boyd who's the

8
00:00:21,830 --> 00:00:20,320
pi for the t-bone study and you got you

9
00:00:23,509 --> 00:00:21,840
guys are looking at bones you're looking

10
00:00:25,189 --> 00:00:23,519
at you know kind of the

11
00:00:27,109 --> 00:00:25,199
deep insides of our bodies when you're

12
00:00:29,269 --> 00:00:27,119
up there first off give me a little

13
00:00:31,269 --> 00:00:29,279

general background what happens to bones

14
00:00:33,430 --> 00:00:31,279
when you're up in microgravity oh thanks

15
00:00:35,190 --> 00:00:33,440
dan um

16
00:00:36,549 --> 00:00:35,200
well what we know that for sure when

17
00:00:38,069 --> 00:00:36,559
where people are spending time in space

18
00:00:39,670 --> 00:00:38,079
there's a lot of uh

19
00:00:40,950 --> 00:00:39,680
the lack of gravity which is something

20
00:00:42,229 --> 00:00:40,960
that we've experienced every day on

21
00:00:43,910 --> 00:00:42,239
earth

22
00:00:45,910 --> 00:00:43,920
isn't existing anymore and so with those

23
00:00:47,830 --> 00:00:45,920
bone with the lack of gravity our bones

24
00:00:50,709 --> 00:00:47,840
actually adapt very quickly

25
00:00:53,590 --> 00:00:50,719
so normally as we get older we'll lose

26
00:00:55,590 --> 00:00:53,600
about a percent of bone mass per year

27
00:00:57,750 --> 00:00:55,600
um on earth but when we're in space

28
00:00:59,510 --> 00:00:57,760
actually we can lose up to one to one

29
00:01:01,750 --> 00:00:59,520
and a half percent per month so it's

30
00:01:03,510 --> 00:01:01,760
kind of like aging and fast motion

31
00:01:05,509 --> 00:01:03,520
exactly it's a really accelerated aging

32
00:01:08,310 --> 00:01:05,519
process for for your bones

33
00:01:10,149 --> 00:01:08,320
and so that can really affect um

34
00:01:12,789 --> 00:01:10,159
the most important thing is it'll affect

35
00:01:15,030 --> 00:01:12,799
is your bone strength possibly so

36
00:01:17,510 --> 00:01:15,040
what we're interested in is what happens

37
00:01:20,469 --> 00:01:17,520
in the space in the space environment in

38
00:01:22,550 --> 00:01:20,479

terms of the bones both in terms of

39
00:01:24,149 --> 00:01:22,560
how much bone loss that occurs and how

40
00:01:25,510 --> 00:01:24,159
that might influence the bone strength

41
00:01:27,510 --> 00:01:25,520
okay and you guys are going to be

42
00:01:28,950 --> 00:01:27,520
testing out a new technique for this

43
00:01:30,469 --> 00:01:28,960
research study why don't you tell me a

44
00:01:32,310 --> 00:01:30,479
little bit about what you guys are doing

45
00:01:34,469 --> 00:01:32,320
that's new to help track this bone loss

46
00:01:35,990 --> 00:01:34,479
in the astronauts well the typical way

47
00:01:38,870 --> 00:01:36,000
that people measure bones is they look

48
00:01:40,789 --> 00:01:38,880
at bone density and that's a standard

49
00:01:42,950 --> 00:01:40,799
tool we use on earth all the time for

50
00:01:45,030 --> 00:01:42,960
measuring how how well people's bones

51
00:01:46,389 --> 00:01:45,040
are are adapted to the

52
00:01:48,550 --> 00:01:46,399
their function

53
00:01:50,069 --> 00:01:48,560
um the problem with bone density is it's

54
00:01:52,630 --> 00:01:50,079
really a measure of how much bone we

55
00:01:54,710 --> 00:01:52,640
have what we're using is a new tool that

56
00:01:56,950 --> 00:01:54,720
can measure at very high resolution the

57
00:01:59,990 --> 00:01:56,960
three-dimensional bone architecture we

58
00:02:01,510 --> 00:02:00,000
do this at the wrist and ankle of people

59
00:02:03,429 --> 00:02:01,520
but we can measure at a resolution of

60
00:02:05,270 --> 00:02:03,439
about 60 micrometers which if you

61
00:02:08,710 --> 00:02:05,280
compare to human hair which is about 100

62
00:02:10,790 --> 00:02:08,720
micrometers oh wow it's very fine detail

63
00:02:12,309 --> 00:02:10,800

so as opposed to looking at density what

64
00:02:14,070 --> 00:02:12,319
we're interested in is looking at the

65
00:02:16,710 --> 00:02:14,080
underlying structure

66
00:02:18,790 --> 00:02:16,720
density is an important measure and it's

67
00:02:21,190 --> 00:02:18,800
typically of interest because it can

68
00:02:22,790 --> 00:02:21,200
relate to how strong somebody's bones

69
00:02:24,229 --> 00:02:22,800
are but fundamentally what we really

70
00:02:26,790 --> 00:02:24,239
want to know is is the strength of the

71
00:02:28,790 --> 00:02:26,800
bones not particularly their density and

72
00:02:30,630 --> 00:02:28,800
so by looking at this detailed micro

73
00:02:32,470 --> 00:02:30,640
architecture this this detailed

74
00:02:34,309 --> 00:02:32,480
structure we get a much better idea of

75
00:02:37,030 --> 00:02:34,319
what's going on in terms of adaptation

76
00:02:38,229 --> 00:02:37,040
to the loads or lack thereof in space so

77
00:02:39,990 --> 00:02:38,239
really just kind of getting the whole

78
00:02:41,270 --> 00:02:40,000
picture so i know one of the other

79
00:02:43,430 --> 00:02:41,280
things you guys are looking for is

80
00:02:45,190 --> 00:02:43,440
actually the susceptibility that

81
00:02:48,390 --> 00:02:45,200
individuals might have to bone loss is

82
00:02:50,869 --> 00:02:48,400
that true that's right so if if we can

83
00:02:52,550 --> 00:02:50,879
look at the long-term effects of of this

84
00:02:53,750 --> 00:02:52,560
bone loss in space with with the

85
00:02:55,670 --> 00:02:53,760
astronauts

86
00:02:58,309 --> 00:02:55,680
we will be able to track very precisely

87
00:02:59,830 --> 00:02:58,319
how that architecture changes over time

88
00:03:01,750 --> 00:02:59,840

and so when we get a better

89
00:03:04,309 --> 00:03:01,760
understanding of how that architecture

90
00:03:05,910 --> 00:03:04,319
relates to the bone strength then we can

91
00:03:08,149 --> 00:03:05,920
use that information so that when we

92
00:03:10,149 --> 00:03:08,159
bring a new person into a study or an

93
00:03:11,990 --> 00:03:10,159
investigation we can already see where

94
00:03:14,630 --> 00:03:12,000
they are relative to the other data that

95
00:03:16,470 --> 00:03:14,640
we've already collected so so

96
00:03:17,830 --> 00:03:16,480
what is this study going to mean for

97
00:03:19,430 --> 00:03:17,840
future space fliers what are you guys

98
00:03:21,509 --> 00:03:19,440
hoping to learn from this that's going

99
00:03:23,670 --> 00:03:21,519
to you know make the job easier make the

100
00:03:25,910 --> 00:03:23,680
job better for the astronauts of

101
00:03:28,710 --> 00:03:25,920
tomorrow well we're really wanting to

102
00:03:31,030 --> 00:03:28,720
shift away or add to i guess our

103
00:03:33,190 --> 00:03:31,040
measures of bone density to understand

104
00:03:35,270 --> 00:03:33,200
the long-term consequences so what's

105
00:03:37,030 --> 00:03:35,280
really interesting for us actually is

106
00:03:38,550 --> 00:03:37,040
not only what happens to

107
00:03:41,030 --> 00:03:38,560
the bones during space but what happens

108
00:03:42,789 --> 00:03:41,040
during the recovery period so

109
00:03:44,309 --> 00:03:42,799
typically the way we measure recovery

110
00:03:47,110 --> 00:03:44,319
right now for bones is we look at bone

111
00:03:48,869 --> 00:03:47,120
density and typically after a year or so

112
00:03:50,869 --> 00:03:48,879
people get back to close to normal

113
00:03:51,990 --> 00:03:50,879

levels after being in space

114
00:03:53,670 --> 00:03:52,000
but

115
00:03:55,190 --> 00:03:53,680
what we know is that the underlying

116
00:03:57,270 --> 00:03:55,200
micro architecture this structure

117
00:03:59,429 --> 00:03:57,280
underneath may not be the same as it was

118
00:04:00,390 --> 00:03:59,439
before they left earth

119
00:04:01,830 --> 00:04:00,400
and so

120
00:04:03,429 --> 00:04:01,840
that kind of information will not only

121
00:04:06,149 --> 00:04:03,439
be important for understanding long-term

122
00:04:07,670 --> 00:04:06,159
space flight for for astronauts but will

123
00:04:09,509 --> 00:04:07,680
also be important for understanding the

124
00:04:11,429 --> 00:04:09,519
long-term uh implications of bone

125
00:04:15,110 --> 00:04:11,439
architectural changes in people on earth

126
00:04:16,710 --> 00:04:15,120
okay so and final question so we talked

127
00:04:18,550 --> 00:04:16,720
a little bit about the beginning how

128
00:04:20,390 --> 00:04:18,560
being in space is kind of like aging

129
00:04:21,909 --> 00:04:20,400
everybody down here on earth is aging

130
00:04:23,830 --> 00:04:21,919
obviously are there going to be any

131
00:04:25,749 --> 00:04:23,840
benefits for those of us down here that

132
00:04:28,150 --> 00:04:25,759
aren't going to space from research like

133
00:04:30,070 --> 00:04:28,160
this yeah absolutely i mean as you said

134
00:04:31,909 --> 00:04:30,080
at the at the ons at the outset of this

135
00:04:34,629 --> 00:04:31,919
uh uh discussion

136
00:04:37,510 --> 00:04:34,639
that this is really a model in space of

137
00:04:39,749 --> 00:04:37,520
accelerated aging so what we can learn

138
00:04:42,390 --> 00:04:39,759

in six months of of space flight would

139
00:04:43,670 --> 00:04:42,400
take us a decade on earth so this really

140
00:04:45,510 --> 00:04:43,680
accelerates the whole process of

141
00:04:48,310 --> 00:04:45,520
learning how microarchitecture relates

142
00:04:49,990 --> 00:04:48,320
to uh bone strength in the end so really

143
00:04:51,749 --> 00:04:50,000
interested in these outcomes very very

144
00:04:53,990 --> 00:04:51,759
cool stuff again dr stephen boyd the

145
00:04:55,590 --> 00:04:54,000
principal investigator of t-bone one of

146
00:04:57,189 --> 00:04:55,600
the new bone studies taking place right

147
00:04:58,390 --> 00:04:57,199
now on board the international space

148
00:05:00,150 --> 00:04:58,400
station doctor thanks so much for