1
00:00:07,639 --> 00:00:06,320
the weightless environment of the

2
00:00:09,890 --> 00:00:07,649
international space station provides

3
00:00:11,480 --> 00:00:09,900
opportunities for science research that

4
00:00:13,759 --> 00:00:11,490
just aren't available here on earth and

5
00:00:15,709 --> 00:00:13,769
the spacex dragon cargo ship launching

6
00:00:17,330 --> 00:00:15,719
on friday will be bringing new

7
00:00:19,760 --> 00:00:17,340
experiments to orbit to take advantage

8
00:00:22,580 --> 00:00:19,770
of that one of them focuses on growing

9
00:00:24,740 --> 00:00:22,590
protein fibers such as those implicated

10
00:00:26,599 --> 00:00:24,750
in Alzheimer's disease as a step and

11
00:00:29,480 --> 00:00:26,609
possibly developing better treatments

12
00:00:31,519 --> 00:00:29,490
the experiment is called NanoRacks

13
00:00:33,590 --> 00:00:31,529

self-assembly in biology and the

14
00:00:36,229 --> 00:00:33,600
original life and the principal

15
00:00:38,270 --> 00:00:36,239
investigator is dr. Sam Durant's the

16
00:00:40,040 --> 00:00:38,280
Florida Institute of Technology who flew

17
00:00:42,260 --> 00:00:40,050
as a payload specialist on a space

18
00:00:46,459 --> 00:00:42,270
shuttle mission our special missions in

19
00:00:48,560 --> 00:00:46,469
1990 and 1995 Sam joins us this morning

20
00:00:51,200 --> 00:00:48,570
to talk about his new orbital research

21
00:00:52,970 --> 00:00:51,210
thanks so much Sam sure you're welcome

22
00:00:54,889 --> 00:00:52,980
Brandi well why don't we start by

23
00:00:56,389 --> 00:00:54,899
talking about what exactly it is about

24
00:01:00,250 --> 00:00:56,399
the space environment that's so

25
00:01:02,540 --> 00:01:00,260
important to this new experiment okay

26
00:01:04,039 --> 00:01:02,550
well when we grow fibers in the

27
00:01:05,870 --> 00:01:04,049
laboratory they're affected by

28
00:01:08,240 --> 00:01:05,880
gravitational settling in other words

29
00:01:10,270 --> 00:01:08,250
they settle our sink towards the bottom

30
00:01:13,429 --> 00:01:10,280
of the vials that they're growing in

31
00:01:16,429 --> 00:01:13,439
this affects how the fibers interact

32
00:01:18,440 --> 00:01:16,439
with each other and they eventually form

33
00:01:21,800 --> 00:01:18,450
like a tangled web of interlocking

34
00:01:25,280 --> 00:01:21,810
fibers near the bottom of the file and

35
00:01:29,660 --> 00:01:25,290
weightlessness this will not deceitful

36
00:01:34,210 --> 00:01:29,670
not occur so it will change the somewhat

37
00:01:36,710 --> 00:01:34,220
the way the primers form also fibers

38
00:01:39,230 --> 00:01:36,720

growth process may be affected by

39
00:01:40,580 --> 00:01:39,240
natural convection we're not sure and

40
00:01:44,510 --> 00:01:40,590
that will not be President

41
00:01:46,310 --> 00:01:44,520
weightlessness either so you say they

42
00:01:48,499 --> 00:01:46,320
form tangled webs is that the

43
00:01:52,340 --> 00:01:48,509
self-assembly that the name of the

44
00:01:55,179 --> 00:01:52,350
investigation refers to now if you look

45
00:01:58,370 --> 00:01:55,189
at our image of the protein fibers

46
00:02:01,850 --> 00:01:58,380
you'll see that there are two images

47
00:02:04,700 --> 00:02:01,860
there on the left is an early stage of

48
00:02:08,869 --> 00:02:04,710
the fiber from growth process and on the

49
00:02:09,830 --> 00:02:08,879
right is the a 20 days or so so it's a

50
00:02:12,580 --> 00:02:09,840
longer

51
00:02:17,360 --> 00:02:12,590
and the fibers themselves form these

52
00:02:18,619 --> 00:02:17,370
tangles in the bottom and so I'm not

53
00:02:20,869 --> 00:02:18,629
sure what was your question about that

54
00:02:22,339 --> 00:02:20,879
the self-assembly then it's part of the

55
00:02:24,170 --> 00:02:22,349
name you know the self-assembly is the

56
00:02:27,979 --> 00:02:24,180
fiber growth process itself no we're

57
00:02:32,210 --> 00:02:27,989
seriously a protein powder in a solution

58
00:02:35,000 --> 00:02:32,220
and they spontaneously form these long

59
00:02:39,470 --> 00:02:35,010
thin fibers which are anywhere from one

60
00:02:41,300 --> 00:02:39,480
to a few proteins in diameter and can be

61
00:02:43,460 --> 00:02:41,310
which is a few nanometers in but they

62
00:02:45,440 --> 00:02:43,470
can be microns long so it's a

63
00:02:47,569 --> 00:02:45,450

spontaneous growth of these fibers they

64
00:02:50,449 --> 00:02:47,579
self assemble from the solution of

65
00:02:52,280 --> 00:02:50,459
proteins into long thin fibers okay and

66
00:02:55,069 --> 00:02:52,290
I think you develop some new hardware to

67
00:02:58,670 --> 00:02:55,079
study that specifically what why was

68
00:03:01,039 --> 00:02:58,680
that necessary yes so the we want to

69
00:03:04,369 --> 00:03:01,049
study the growth process and the time

70
00:03:06,890 --> 00:03:04,379
period is around 25 days or so to move

71
00:03:10,069 --> 00:03:06,900
from proteins in solution to this

72
00:03:12,740 --> 00:03:10,079
tangled web that we find and we need to

73
00:03:15,800 --> 00:03:12,750
sample it every few days and we sample

74
00:03:17,809 --> 00:03:15,810
it and the data we measure it is we use

75
00:03:20,539 --> 00:03:17,819
an atomic force microscope to image the

76
00:03:23,030 --> 00:03:20,549
fibers and that's just not present at

77
00:03:27,050 --> 00:03:23,040
present possible to do on the space

78
00:03:30,440 --> 00:03:27,060
station so we had to build a device to

79
00:03:33,199 --> 00:03:30,450
do that and our experiment our picture

80
00:03:35,870 --> 00:03:33,209
of our experiment you can see there's a

81
00:03:39,849 --> 00:03:35,880
small automated device that's designed

82
00:03:44,270 --> 00:03:39,859
to accomplish this day we do that by

83
00:03:46,039 --> 00:03:44,280
using nine individual vials and each of

84
00:03:48,770 --> 00:03:46,049
which will incubate this protein

85
00:03:52,759 --> 00:03:48,780
solution for a different time interval

86
00:03:56,839 --> 00:03:52,769
that way we can cover the time intervals

87
00:03:58,490 --> 00:03:56,849
from for 25 days at about three day

88
00:04:01,849 --> 00:03:58,500

intervals like that so we'll have a

89
00:04:05,300 --> 00:04:01,859
sample and we don't start the incubation

90
00:04:08,360 --> 00:04:05,310
in each of the vials until we inject the

91
00:04:10,430 --> 00:04:08,370
protein powder into the solution their

92
00:04:13,069 --> 00:04:10,440
health separate until they reach orbit

93
00:04:15,559 --> 00:04:13,079
and then on each file a small stepper

94
00:04:17,899 --> 00:04:15,569
motor pushes the powder solution down

95
00:04:20,180 --> 00:04:17,909
into the powder down into the buffer

96
00:04:22,580 --> 00:04:20,190
solution and then we raise the

97
00:04:23,610 --> 00:04:22,590
temperature to 55 degrees c and the

98
00:04:26,939 --> 00:04:23,620
incubation starts

99
00:04:30,900 --> 00:04:26,949
and so we do that in a series so that we

100
00:04:34,170 --> 00:04:30,910
cover intervals and then when we get it

101
00:04:35,820 --> 00:04:34,180
back in Florida we bring it into the

102
00:04:37,230 --> 00:04:35,830
laboratory and we can measure each of

103
00:04:40,860 --> 00:04:37,240
the samples so that we will have this

104
00:04:42,600 --> 00:04:40,870
time series so is the goal that that

105
00:04:45,900 --> 00:04:42,610
you'll be able to develop treatments for

106
00:04:49,020 --> 00:04:45,910
Alzheimer's and similar diseases sure

107
00:04:50,790 --> 00:04:49,030
that mean that's a long term dream right

108
00:04:52,980 --> 00:04:50,800
now that what we're trying to do is

109
00:04:55,860 --> 00:04:52,990
completely understand the process of

110
00:04:57,840 --> 00:04:55,870
this self-assembly of proteins from

111
00:05:01,460 --> 00:04:57,850
solution and there are many proteins

112
00:05:05,700 --> 00:05:01,470
that do that the one we're using is a

113
00:05:08,219 --> 00:05:05,710

model that is inexpensive and it shows

114
00:05:11,460 --> 00:05:08,229
all the characteristics of all the other

115
00:05:12,750 --> 00:05:11,470
proteins that do this and Alzheimer's is

116
00:05:14,340 --> 00:05:12,760
one there are a couple of proteins that

117
00:05:18,510 --> 00:05:14,350
are implicated in Alzheimer's disease

118
00:05:20,279 --> 00:05:18,520
they both form protein fibers and the

119
00:05:22,740 --> 00:05:20,289
manner similar to what we're studying

120
00:05:26,490 --> 00:05:22,750
and so once we understand that process

121
00:05:27,600 --> 00:05:26,500
we might be able to then lead to an

122
00:05:30,000 --> 00:05:27,610
understanding of the cause of

123
00:05:32,310 --> 00:05:30,010
Alzheimer's disease and maybe even

124
00:05:34,140 --> 00:05:32,320
eventually a cure or treatment that

125
00:05:35,700 --> 00:05:34,150
would certainly be wonderful we got look

126
00:05:37,589 --> 00:05:35,710
forward to seeing that launched on on

127
00:05:39,750 --> 00:05:37,599
Friday and hearing more about the

128
00:05:42,839 --> 00:05:39,760
results in the coming months yeah we're

129
00:05:44,310 --> 00:05:42,849
of course are very excited and you know

130
00:05:45,750 --> 00:05:44,320
be delighted to share it with you when

131
00:05:47,730 --> 00:05:45,760
we get it back and tell you what we've

132
00:05:49,110 --> 00:05:47,740
learned thank you so much for joining us

133
00:05:51,960 --> 00:05:49,120
this again with Sam Durant's the

134
00:05:53,909 --> 00:05:51,970
principal investigator for NanoRacks