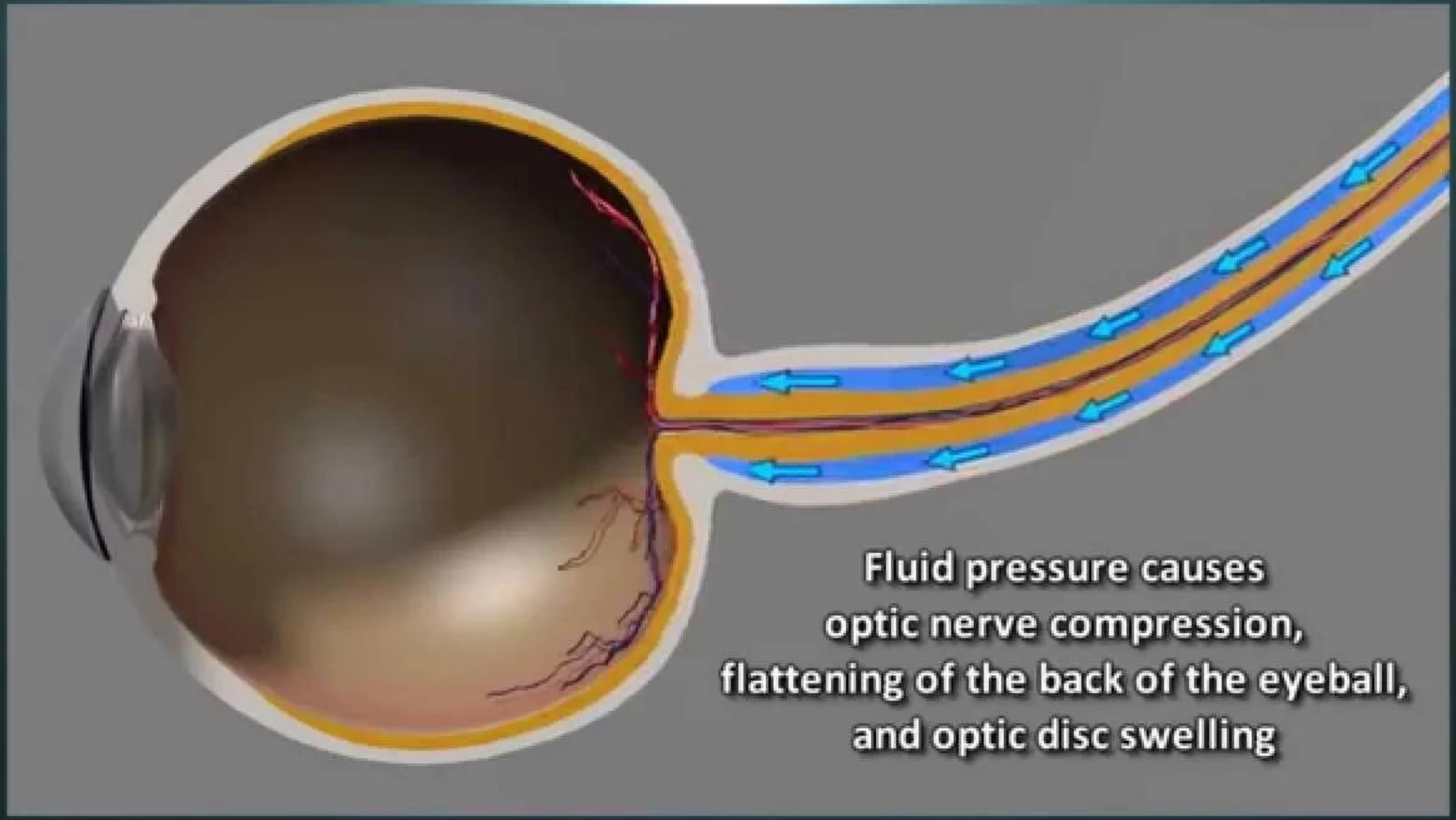
Fluid pressure causes
optic nerve compression,
flattening of the back of the eyeball,
and optic disc swelling

1
00:00:00,506 --> 00:00:03,391
[Music]

2
00:00:03,891 --> 00:00:06,776
[Dramatic Noise]

3
00:00:07,276 --> 00:00:10,161
[Wooshing Noise]

4
00:00:10,661 --> 00:00:13,546
[Dripping Noise]

5
00:00:14,046 --> 00:00:14,886
>> All those in favor, say aye.

6
00:00:14,886 --> 00:00:17,126
The aye's have it!

7
00:00:17,426 --> 00:00:19,366
We're talking healthy
vision and the effects

8
00:00:19,366 --> 00:00:20,846
of space flight on human health.

9
00:00:21,136 --> 00:00:23,396
Hi, I'm NASA astronaut
Tracy Dyson.

10
00:00:23,556 --> 00:00:24,976
Welcome to Station Life.

11
00:00:25,516 --> 00:00:37,546
[Space Radio Transmissions]

12
00:00:38,046 --> 00:00:39,226
Hi. Welcome back.

13
00:00:39,506 --> 00:00:41,496
This month on Station
Life, we're going to look

14
00:00:41,496 --> 00:00:44,766
at how the unique environment
of space affects the human body.

15
00:00:45,316 --> 00:00:48,166
In recent years, a new
trend has been identified.

16
00:00:48,436 --> 00:00:49,646
It seems some astronauts

17
00:00:49,646 --> 00:00:51,966
from the International Space
Station have reported vision

18
00:00:51,966 --> 00:00:53,726
degradation during
their space flight.

19
00:00:54,366 --> 00:00:56,926
So research has identified
a possible link

20
00:00:56,926 --> 00:00:58,176
between vision impairment

21
00:00:58,176 --> 00:01:01,586
and the increased intracranial
pressure that's caused

22
00:01:01,586 --> 00:01:04,696
by the shifting of bodily fluids
from the lower extremities

23
00:01:04,696 --> 00:01:07,916

to the upper parts of the body
in a micro-gravity environment.

24
00:01:07,976 --> 00:01:11,176
This is an area of intense
interest onboard the ISS

25
00:01:11,266 --> 00:01:13,876
with implications for
future exploration missions.

26
00:01:14,236 --> 00:01:16,966
So watch now NASA
scientist, Jennifer Fogarty,

27
00:01:16,966 --> 00:01:18,926
explain this phenomenon.

28
00:01:18,926 --> 00:01:19,296
[Drip Noise]

29
00:01:19,296 --> 00:01:20,956
>> One of the things we
found over the years,

30
00:01:20,956 --> 00:01:23,256
is that there are changes
in the astronaut's eyes.

31
00:01:23,416 --> 00:01:25,506
Initially, in the
earlier programs,

32
00:01:25,616 --> 00:01:26,786
all the way through
the first part

33
00:01:26,786 --> 00:01:28,836
of International Space Changes,
we thought those changes

34
00:01:28,836 --> 00:01:30,816
in people's vision--
how they see things--

35
00:01:31,236 --> 00:01:33,416
was just temporary and minor.

36
00:01:33,416 --> 00:01:35,906
About halfway through our
International Space Station

37
00:01:35,906 --> 00:01:37,206
experience, we noticed that some

38
00:01:37,206 --> 00:01:39,996
of the astronauts' vision
changes were a little bit more

39
00:01:39,996 --> 00:01:43,286
severe, in that they had a
harder time seeing objects both

40
00:01:43,286 --> 00:01:47,076
near and far, and also the
vision didn't go back to normal

41
00:01:47,076 --> 00:01:48,856
as quickly as we expected it to.

42
00:01:49,076 --> 00:01:51,066
So, we started looking
a lot more closely

43
00:01:51,066 --> 00:01:51,896
at the back of the eye.

44
00:01:51,896 --> 00:01:53,826
What we noticed that

tissue in the back

45
00:01:53,826 --> 00:01:56,116
of the eye became a little bit
more swollen, and the shape

46
00:01:56,116 --> 00:01:58,376
of the eye changed, but
the big question is why.

47
00:01:58,806 --> 00:02:00,626
Why would someone's
eye change shape?

48
00:02:00,726 --> 00:02:02,906
Why would the back of
the eye become swollen?

49
00:02:02,906 --> 00:02:06,096
One of the major changes that
we've been able to document

50
00:02:06,096 --> 00:02:08,776
and understand is how
the blood volume shifts

51
00:02:08,896 --> 00:02:10,596
from your lower body
to your upper body

52
00:02:10,596 --> 00:02:11,796
when you go into micro-gravity.

53
00:02:11,796 --> 00:02:14,376
So things happen like
your nose gets stuffy,

54
00:02:14,376 --> 00:02:16,396
your eyes feel a
little bit of pressure.

55
00:02:16,396 --> 00:02:17,936
It feels like you have
a really bad head cold.

56
00:02:17,936 --> 00:02:22,156
Well we think that that change
in fluid volume and that shift,

57
00:02:22,156 --> 00:02:24,376
might be behind those
changes in the eye.

58
00:02:24,376 --> 00:02:26,316
We also think it could
be affecting the brain

59
00:02:26,316 --> 00:02:29,436
and changing what's called
intracranial pressure.

60
00:02:29,436 --> 00:02:31,346
Normally, we measure
intracranial pressure

61
00:02:31,346 --> 00:02:33,116
through a procedure
lumbar puncture.

62
00:02:33,386 --> 00:02:35,436
In space flight, that would
be very complicated to do,

63
00:02:35,436 --> 00:02:36,736
and we wouldn't want
to necessarily do

64
00:02:36,736 --> 00:02:38,336
that to our astronauts
if we didn't have to,

65
00:02:38,336 --> 00:02:41,476
so we look for non-invasive
ways of measuring pressure

66
00:02:41,476 --> 00:02:44,326
in your brain through
your eyes or your ears,

67
00:02:44,326 --> 00:02:46,286
or how much blood
flow is actually going

68
00:02:46,286 --> 00:02:47,906
to your brain using ultrasound.

69
00:02:47,906 --> 00:02:51,366
So, NASA has a lot of work
ahead to understand the use

70
00:02:51,366 --> 00:02:52,856
of these non-invasive devices,

71
00:02:52,856 --> 00:02:55,146
both terrestrially
and in flight.

72
00:02:55,146 --> 00:03:00,656
Part of our job is to understand
how we use these tools before,

73
00:03:00,656 --> 00:03:04,236
during and after a space
mission to compare the results.

74
00:03:04,236 --> 00:03:05,786
In the process, we
determine kind

75

00:03:05,786 --> 00:03:07,526
of how valid these
procedures are,

76
00:03:07,526 --> 00:03:10,216
how mature the technologies are,

77
00:03:10,216 --> 00:03:12,596
and how well we can apply
them not only to space flight,

78
00:03:12,596 --> 00:03:14,936
but what would be appropriate
for spin back to Earth.

79
00:03:15,516 --> 00:03:20,516
[Music]

80
00:03:21,016 --> 00:03:30,506
[Space Noise]

81
00:03:31,006 --> 00:03:39,516
[Music]

82
00:03:40,016 --> 00:03:45,000
[Space Noise]

83
00:03:45,136 --> 00:03:46,356
>> So by now, you've
probably heard

84
00:03:46,356 --> 00:03:47,856
about the 1-year
mission that's going

85
00:03:47,856 --> 00:03:50,596
on right now on board the ISS.

86
00:03:50,596 --> 00:03:52,736

One of the focal points
of this mission is

87
00:03:52,736 --> 00:03:55,106
to better understand
how does the body react

88
00:03:55,156 --> 00:03:56,646
to prolonged space flight?

89
00:03:56,936 --> 00:03:59,816
It's imperative that we
understand what these effects

90
00:03:59,816 --> 00:04:02,806
are, and develop
appropriate counter measures,

91
00:04:02,806 --> 00:04:05,066
especially if we're going
to go further into space

92
00:04:05,066 --> 00:04:07,376
on longer missions
such as going to Mars.

93
00:04:07,636 --> 00:04:10,946
So, let's learn more about fluid
shifts and ocular health on ISS.

94
00:04:11,016 --> 00:04:11,306
[Drip Noise]

95
00:04:11,306 --> 00:04:11,596
[Music]

96
00:04:11,596 --> 00:04:16,156
>> Did you know the human
body is made up of more

97
00:04:16,156 --> 00:04:19,806
than 60 percent water, and with
that comes challenges we deal

98
00:04:19,806 --> 00:04:20,916
with in our everyday life.

99
00:04:21,526 --> 00:04:24,686
Hi. I'm Dr. John Charles from
NASA's human research program.

100
00:04:25,536 --> 00:04:27,836
During the 1-year International
Space Station mission,

101
00:04:27,836 --> 00:04:30,606
NASA will conduct visual
impairment studies to learn more

102
00:04:30,606 --> 00:04:32,316
about fluid shifts
and vision health.

103
00:04:32,536 --> 00:04:35,466
Here on Earth, some of us
experience swelling in our legs

104
00:04:35,466 --> 00:04:38,036
or get dizzy when we stand
up to quickly or suffer

105
00:04:38,036 --> 00:04:39,296
from elevated blood pressure.

106
00:04:40,166 --> 00:04:43,316
These common ailments faced on
Earth are related to the amount

107
00:04:43,316 --> 00:04:46,456

of fluids in our bodies, and
how they are redistributed

108
00:04:46,456 --> 00:04:47,606
when we change posture.

109
00:04:48,746 --> 00:04:50,866
Remember swinging upside
down on the monkey bars

110
00:04:50,866 --> 00:04:51,666
when you were a child?

111
00:04:52,106 --> 00:04:54,346
You may have felt a heavy
sensation around your eyes.

112
00:04:55,246 --> 00:04:56,606
When astronauts are in space,

113
00:04:56,716 --> 00:04:58,436
they may experience
a similar feeling,

114
00:04:58,436 --> 00:05:01,356
as weightlessness causes fluids
to shift to the upper body.

115
00:05:02,306 --> 00:05:05,356
With this fluid shift persisting
for weeks and months in space,

116
00:05:05,356 --> 00:05:08,496
and not just seconds on the
money bars, pressure may build

117
00:05:08,496 --> 00:05:11,056
up around the brain and behind
the eye and affect their vision.

118
00:05:11,476 --> 00:05:14,076
In the past, we thought this
was a temporary problem,

119
00:05:14,186 --> 00:05:16,816
but now believe it may be
a more significant concern.

120
00:05:17,806 --> 00:05:20,796
Two visual impairment studies
which use non-invasive tools

121
00:05:20,796 --> 00:05:23,646
like ultrasound devices,
high resolution photography,

122
00:05:23,646 --> 00:05:27,036
and blood pressure monitors will
assess what happens in the body

123
00:05:27,036 --> 00:05:29,156
when fluid volume
shifts before, during,

124
00:05:29,156 --> 00:05:30,956
and after long-duration
space flight.

125
00:05:32,036 --> 00:05:34,176
Researchers hope to be able
to predict the magnitude

126
00:05:34,176 --> 00:05:37,496
of these shifts and understand
the causes of related diseases.

127
00:05:38,766 --> 00:05:41,126
Vision is a critical sense
on Earth and in orbit,

128
00:05:41,276 --> 00:05:43,506
and it is imperative we
learn more as we prepare

129
00:05:43,506 --> 00:05:46,216
for future missions to
asteroids, Mars, and beyond.

130
00:05:47,246 --> 00:05:50,016
Patients on Earth suffer from
similar problems may benefit

131
00:05:50,016 --> 00:05:51,966
from NASA's research
of this syndrome,

132
00:05:52,626 --> 00:05:53,716
and the increased focus

133
00:05:53,716 --> 00:05:55,506
on non-invasive measurement
technique.

134
00:05:56,016 --> 00:05:58,256
To learn more about NASA's
human research program,

135
00:05:58,316 --> 00:06:00,456
visit www.NASA.gov.

136
00:06:01,516 --> 00:06:04,781
[Music]

137
00:06:05,281 --> 00:06:08,546
[Typing Noise]

138
00:06:09,046 --> 00:06:10,516
>> When you're up
there for six months,

139
00:06:10,516 --> 00:06:12,706
or in Scott Kelly's
case, an entire year,

140
00:06:12,706 --> 00:06:15,806
it's really the working in space
part that becomes, kind of,

141
00:06:15,806 --> 00:06:16,936
the thing you love the most.

142
00:06:16,936 --> 00:06:17,926
It's the thing that gets you

143
00:06:17,926 --> 00:06:20,776
through the day is you're
working with these professionals

144
00:06:20,776 --> 00:06:23,506
on the ground, and a lot of them
have spent their entire lives

145
00:06:23,506 --> 00:06:25,996
working on these science
experiments, and here we are

146
00:06:25,996 --> 00:06:27,246
up there, and we
get to operate them.

147
00:06:27,246 --> 00:06:30,416
And it's really an honor to get
to do that, and in many ways,

148
00:06:30,416 --> 00:06:34,326
those are some of my fondest
memories of being in space.

149

00:06:34,326 --> 00:06:36,436
You get to work these
experiments

150
00:06:36,536 --> 00:06:38,346
and they're usually
watching over your shoulder

151
00:06:38,346 --> 00:06:40,046
from the ground, and
there was a lot of times

152
00:06:40,046 --> 00:06:42,226
where I would do something,
whether it was fluids,

153
00:06:42,226 --> 00:06:44,316
or with flame research,
it really didn't matter--

154
00:06:44,426 --> 00:06:47,186
the investigator would just
say, whoa, whoa, whoa, wait,

155
00:06:47,186 --> 00:06:48,806
do that again, that
was incredible

156
00:06:48,926 --> 00:06:50,046
and totally unexpected.

157
00:06:50,336 --> 00:06:53,676
And that was what just made you
smile big up there, when hey,

158
00:06:53,676 --> 00:06:55,306
we've been flying in
space a long, long time,

159
00:06:55,386 --> 00:06:57,006

but we are still doing research

160
00:06:57,046 --> 00:06:59,586
that has unexpected
results every single day

161
00:06:59,586 --> 00:07:01,106
on the Space Station,
and I really loved

162
00:07:01,106 --> 00:07:01,886
that about being up there.

163
00:07:02,516 --> 00:07:05,316
[Music]

164
00:07:05,816 --> 00:07:08,616
[Computer Ringing Noise]

165
00:07:09,116 --> 00:07:11,916
[Music]

166
00:07:12,416 --> 00:07:12,846
>> Hi, there.

167
00:07:13,146 --> 00:07:14,486
We have a special guest for you.

168
00:07:14,926 --> 00:07:17,626
We have with us today,
someone who is no stranger

169
00:07:17,626 --> 00:07:19,976
to human health and
space flight combined.

170
00:07:20,426 --> 00:07:22,736
Let me introduce fellow
astronaut, Dr. Mike Barratt.

171
00:07:23,446 --> 00:07:24,016
>> How're you doing today?

172
00:07:24,076 --> 00:07:24,143
>> I'm--

173
00:07:24,143 --> 00:07:25,496
>> Tracy, it's really
good to be here with you.

174
00:07:25,586 --> 00:07:27,016
>> It's great to have
you here with us.

175
00:07:27,206 --> 00:07:28,696
Thank you so much,
Mike, for joining us--

176
00:07:28,726 --> 00:07:29,156
>> My pleasure.

177
00:07:29,156 --> 00:07:31,676
>> -- for joining
us on Station Life.

178
00:07:31,676 --> 00:07:33,936
So, now, the fluid
shifts in the body

179
00:07:34,216 --> 00:07:35,786
in the micro-gravity
environment.

180
00:07:35,786 --> 00:07:37,706
You are no stranger to this.

181
00:07:37,856 --> 00:07:41,716
You're familiar with it both

professionally and personally.

182
00:07:41,716 --> 00:07:44,166
Can you tell us a little bit
about it from both perspectives?

183
00:07:44,446 --> 00:07:45,196
>> Well, like you, Tracy.

184
00:07:45,196 --> 00:07:48,116
I've had the opportunity to
experience the fluid shifts,

185
00:07:48,116 --> 00:07:51,216
and so when we fly into space,
a lot of things happen to us,

186
00:07:51,216 --> 00:07:53,926
and immediately when the
engines cut off, we almost feel

187
00:07:53,926 --> 00:07:55,576
like we're hanging upside down.

188
00:07:55,576 --> 00:07:58,536
That's what I remember, is being
three years old and hanging

189
00:07:58,536 --> 00:08:00,716
from the monkey bars and
feeling the fluid kind

190
00:08:00,716 --> 00:08:01,756
of rush to your head.

191
00:08:01,976 --> 00:08:02,126
>> Yeah.

192
00:08:02,216 --> 00:08:03,946

>> And you kind of feel
full and everything there,

193
00:08:04,336 --> 00:08:06,346
and that's just one of the
things that happens to you

194
00:08:06,346 --> 00:08:07,156
when you fly in space.

195
00:08:07,486 --> 00:08:11,046
But it's really an amazing
thing, because it's a small part

196
00:08:11,046 --> 00:08:14,156
of a very large change that
happens to the human body.

197
00:08:14,596 --> 00:08:17,206
We start adapting
to weightlessness,

198
00:08:17,696 --> 00:08:20,356
and so many different things
happen, that at the end

199
00:08:20,356 --> 00:08:23,886
of this adaptation, we almost
become extra-terrestrials,

200
00:08:23,976 --> 00:08:24,416
if you will.

201
00:08:24,736 --> 00:08:25,786
Our body is different.

202
00:08:25,786 --> 00:08:28,886
It changes shape, the
physiology is changes,

203
00:08:28,886 --> 00:08:31,436
our blood flow changes,
our heart changes shape,

204
00:08:31,636 --> 00:08:35,016
everything changes, and it makes
us better for space flight.

205
00:08:35,016 --> 00:08:37,316
It makes us function
better in weightlessness.

206
00:08:37,756 --> 00:08:39,356
But it can leave some problems,

207
00:08:39,356 --> 00:08:41,076
especially when you
want to come home.

208
00:08:41,326 --> 00:08:44,966
>> Yeah. So, kind of, give a
little bit of an example of what

209
00:08:44,966 --> 00:08:45,686
that problem would be.

210
00:08:45,816 --> 00:08:47,066
>> Well, one of the big things

211
00:08:47,066 --> 00:08:49,936
that we've really recently
discovered is a change

212
00:08:49,936 --> 00:08:50,366
in vision.

213
00:08:50,936 --> 00:08:53,396
And, I was actually up
there on my first flight

214
00:08:53,396 --> 00:08:56,456
about five years ago or
so, and maybe three months

215
00:08:56,456 --> 00:08:59,316
into the flight, I noticed
that I needed stronger glasses

216
00:08:59,316 --> 00:09:01,566
to read my check-lists,
and I thought, well,

217
00:09:01,566 --> 00:09:04,136
I know that some people have
said they needed stronger

218
00:09:04,136 --> 00:09:07,286
magnification before, so
let's see if we can find

219
00:09:07,286 --> 00:09:08,196
out something about this.

220
00:09:08,196 --> 00:09:12,396
And myself and my co-worker, Bob
Thirsk, who was also up there,

221
00:09:12,666 --> 00:09:15,046
who is also a doctor, by the
way, doctors rock in space.

222
00:09:15,146 --> 00:09:16,636
>> Doctors are great in space!

223
00:09:16,756 --> 00:09:17,396
>> Thank you.

224
00:09:17,396 --> 00:09:17,463

[Laughter]

225
00:09:17,463 --> 00:09:19,786
But we looked in
each other's eyes,

226
00:09:19,786 --> 00:09:21,846
and we thought we saw a
little bit of swelling

227
00:09:21,846 --> 00:09:24,896
of the optic nerve, which we
thought, oh that's very unusual.

228
00:09:25,576 --> 00:09:28,646
And we talked to our really
smart friends on the ground,

229
00:09:28,646 --> 00:09:31,046
and they actually sent
us some special hardware

230
00:09:31,046 --> 00:09:34,776
that gave us really good
looks at the back of the eye.

231
00:09:34,776 --> 00:09:34,866
>> Oh.

232
00:09:34,866 --> 00:09:35,076
>> And--

233
00:09:35,076 --> 00:09:36,456
>> First, I've got
to ask, how did you--

234
00:09:36,456 --> 00:09:38,756
how were you looking at
each other's optic nerve?

235
00:09:39,036 --> 00:09:40,106
>> Well, that's a good question.

236
00:09:40,106 --> 00:09:42,676
So, on the space station
in the medical kits,

237
00:09:42,676 --> 00:09:45,346
we have this little instrument
that the doctor may hold

238
00:09:45,346 --> 00:09:48,376
up to your eye some time and
just take a real good look

239
00:09:48,376 --> 00:09:49,306
at the back of your eye.

240
00:09:49,306 --> 00:09:50,076
Yeah, that's a good one.

241
00:09:50,076 --> 00:09:50,296
[Laughter]

242
00:09:50,296 --> 00:09:53,886
And so, we can see
things, actually,

243
00:09:53,886 --> 00:09:55,836
that we would be worried
about as a doctor,

244
00:09:55,996 --> 00:09:58,546
but this time it gave us
a chance to see things

245
00:09:58,876 --> 00:10:01,016
that are new as scientists,

246
00:10:01,016 --> 00:10:04,246
and so they gave us
a much better camera.

247
00:10:04,246 --> 00:10:06,576
Within about six weeks, they
launched this thing to us,

248
00:10:06,676 --> 00:10:08,356
and lo and behold, indeed,

249
00:10:08,436 --> 00:10:10,706
we did see some swelling
of the optic nerve.

250
00:10:11,226 --> 00:10:13,896
We saw some other changes in the
back of the eye in the retina,

251
00:10:14,386 --> 00:10:17,616
and then we also did ultra
sound that gave us a good look

252
00:10:17,616 --> 00:10:19,306
at the shape of the
eye, and you know,

253
00:10:19,306 --> 00:10:20,866
we saw some subtle changes.

254
00:10:21,576 --> 00:10:23,936
So, we were starting
to peel off the layers

255
00:10:23,936 --> 00:10:26,506
of something we had known
about for a long time,

256
00:10:26,506 --> 00:10:27,616

but just didn't know why.

257
00:10:28,206 --> 00:10:29,526
>> Well, you know,
this is amazing.

258
00:10:29,526 --> 00:10:32,206
This is-- not only is
it great to have doctors

259
00:10:32,256 --> 00:10:34,016
that have this kind
of expertise on board,

260
00:10:34,276 --> 00:10:42,096
but to have the curiosity propel
them to look deeper to initiate,

261
00:10:42,096 --> 00:10:46,096
I think, something that is very
important not only to our health

262
00:10:46,096 --> 00:10:50,156
on board the Space Station, but
to people on Earth, as well.

263
00:10:50,406 --> 00:10:52,736
I think-- I want to not only
commend you, but thank you--

264
00:10:52,736 --> 00:10:52,803
[Laughter]

265
00:10:52,803 --> 00:10:54,466
-- on behalf of--

266
00:10:54,696 --> 00:10:54,926
>> Well--

267

00:10:54,926 --> 00:10:57,176
>> -- on behalf of all
of us, myself included.

268
00:10:57,176 --> 00:10:59,046
>> I accept your thanks,
but I also have to mention

269
00:10:59,046 --> 00:11:00,236
that there are so many--

270
00:11:00,236 --> 00:11:00,526
>> Thank you, yes.

271
00:11:00,526 --> 00:11:02,346
>> -- really smart
people on the ground

272
00:11:02,346 --> 00:11:03,606
who have been helping
us do this,

273
00:11:04,086 --> 00:11:05,726
and some of them are doctors,

274
00:11:05,726 --> 00:11:07,956
and some of them are
researchers, and the problem is

275
00:11:07,956 --> 00:11:09,906
so big-- the questions
are so big--

276
00:11:09,906 --> 00:11:11,716
that we just need
lots of heads in this,

277
00:11:11,816 --> 00:11:12,906
and they're doing a great job.

278
00:11:13,326 --> 00:11:16,766
But what the human does when
it gets into weightlessness,

279
00:11:17,526 --> 00:11:19,556
immediately the body
shape changes.

280
00:11:19,556 --> 00:11:21,396
The chest actually
gets a little bigger,

281
00:11:21,396 --> 00:11:23,306
the waist gets a
little smaller--

282
00:11:23,456 --> 00:11:24,926
sounds great doesn't it?

283
00:11:24,926 --> 00:11:25,036
>> Yeah!

284
00:11:25,036 --> 00:11:25,103
[Laughter]

285
00:11:25,103 --> 00:11:27,566
>> And that happens
pretty quick.

286
00:11:27,566 --> 00:11:30,166
And your internal organs
actually move along

287
00:11:30,166 --> 00:11:31,086
with the diaphragm.

288
00:11:31,086 --> 00:11:33,256
It actually goes up a little
bit more towards the head.

289
00:11:33,256 --> 00:11:34,736
And that's why your
waist gets smaller.

290
00:11:35,686 --> 00:11:37,726
All the fluid shifts
to your chest

291
00:11:38,076 --> 00:11:40,336
because there's no gravity
keeping it down in your legs.

292
00:11:40,496 --> 00:11:42,476
But really, all of that happens.

293
00:11:42,476 --> 00:11:44,696
Your heart changes,
your blood changes,

294
00:11:44,996 --> 00:11:47,606
the way you regulate your
body fluid changes, your bone

295
00:11:47,606 --> 00:11:51,206
and muscles, unfortunately,
start to come apart

296
00:11:51,486 --> 00:11:53,596
because they're not
challenged by gravity every day.

297
00:11:53,596 --> 00:11:56,526
So, we have to exercise really
hard to keep those up there.

298
00:11:56,816 --> 00:11:58,456
But basically except for that,

299

00:11:58,456 --> 00:12:00,756
become adapted to
weightlessness.

300
00:12:00,756 --> 00:12:02,016
You become an extra-terrestrial.

301
00:12:02,226 --> 00:12:06,136
>> You mentioned earlier, about
all the different investigators,

302
00:12:06,196 --> 00:12:08,656
all the different scientists
and physicians who are trying

303
00:12:08,726 --> 00:12:13,606
to understand this phenomenon
of fluid shifts in micro-gravity

304
00:12:13,946 --> 00:12:15,196
and the effects that
it has on us.

305
00:12:16,496 --> 00:12:19,706
I know you flew on the
Space Station before I did,

306
00:12:19,806 --> 00:12:21,706
and so going back to the--

307
00:12:21,706 --> 00:12:22,166
>> I'm old.

308
00:12:22,166 --> 00:12:22,976
>> -- no. No, no, no.

309
00:12:23,086 --> 00:12:24,206
>> I'm just kidding.

310

00:12:24,306 --> 00:12:25,476
>> That's not where
I'm going with this.

311
00:12:25,476 --> 00:12:25,646
>> Right.

312
00:12:25,956 --> 00:12:29,306
>> The fact that you-- so we
can think about that time period

313
00:12:29,736 --> 00:12:34,766
when you first flew as when
the eye problems started

314
00:12:34,836 --> 00:12:36,496
to be a subject.

315
00:12:36,806 --> 00:12:37,246
>> Mm-hmm.

316
00:12:37,246 --> 00:12:40,296
>> And then when I flew,
which was I think a year or so

317
00:12:40,296 --> 00:12:43,176
after you did, we started
to get instrumentation

318
00:12:43,176 --> 00:12:44,286
on board the Space Station

319
00:12:44,446 --> 00:12:46,226
to actually start
investigating this.

320
00:12:46,276 --> 00:12:48,896
This is when, you know, the
experts started to come together

321
00:12:48,896 --> 00:12:52,256
and say hey, let's
investigate this.

322
00:12:52,516 --> 00:12:52,706
>> Right.

323
00:12:52,956 --> 00:12:55,546
>> And now, today, we
have a full complement

324
00:12:55,976 --> 00:12:59,776
of devices just to
look at the eye.

325
00:12:59,776 --> 00:12:59,876
>> Right.

326
00:13:00,036 --> 00:13:04,206
>> And that is not to
say all the other types

327
00:13:04,246 --> 00:13:08,566
of investigations that are going
on-- focused on fluid shifts,

328
00:13:08,566 --> 00:13:10,906
and so, can you share
anything more that you know

329
00:13:10,906 --> 00:13:13,716
about those investigations,
because I know you work closely

330
00:13:13,966 --> 00:13:16,386
and collaboratively with
all of those investigators

331
00:13:16,426 --> 00:13:17,686

that are involved in it.

332
00:13:17,766 --> 00:13:17,996
>> Right.

333
00:13:17,996 --> 00:13:19,056
>> So, tell us a
little more about that.

334
00:13:19,056 --> 00:13:20,296
>> No, I mean, that's
a great question.

335
00:13:20,296 --> 00:13:23,326
Because one thing we can say
for sure is that the issue

336
00:13:23,326 --> 00:13:25,636
with the eye, it's much
bigger than the eye.

337
00:13:25,636 --> 00:13:28,156
It involves the brain,
the optic nerve,

338
00:13:28,156 --> 00:13:30,576
a lot of the central nervous
system, and it's not new.

339
00:13:30,866 --> 00:13:33,846
It's just that we
missed it for many years.

340
00:13:34,106 --> 00:13:36,706
Now when we go back and
look at medical records,

341
00:13:36,706 --> 00:13:39,306
we find that some of our Russian
colleagues had similar things

342
00:13:39,306 --> 00:13:43,286
going on in the MIR station,
and clearly, it's been happening

343
00:13:43,326 --> 00:13:44,936
since people have
been flying in space.

344
00:13:44,936 --> 00:13:47,026
We know that also from
looking back at our records,

345
00:13:47,516 --> 00:13:50,376
but we missed it because
we didn't have the tools

346
00:13:50,636 --> 00:13:51,536
that we have now.

347
00:13:51,536 --> 00:13:54,056
We didn't have the flight
experience that we have

348
00:13:54,056 --> 00:13:56,676
under our belts now,
and so, basically,

349
00:13:56,736 --> 00:13:58,686
we missed something very big.

350
00:13:58,896 --> 00:14:03,276
A global change that represents
another aspect of adapting

351
00:14:03,276 --> 00:14:05,016
to the zero gravity
which we didn't know.

352

00:14:05,476 --> 00:14:07,476
And why were we able to find it?

353
00:14:07,596 --> 00:14:10,436
Because we have this big,
incredibly equipped laboratory.

354
00:14:10,696 --> 00:14:13,956
So, in a way, the International
Space Station is doing exactly

355
00:14:13,956 --> 00:14:17,636
what it was designed to do:
Providing a big laboratory

356
00:14:17,636 --> 00:14:20,806
with lots of flight
experience and the means

357
00:14:20,856 --> 00:14:22,556
to discover really big things.

358
00:14:22,796 --> 00:14:24,796
Now, you know, but I can
tell you as a doctor,

359
00:14:24,796 --> 00:14:27,716
that the first thing
I think about is boy,

360
00:14:27,716 --> 00:14:29,346
we need to understand this

361
00:14:29,506 --> 00:14:31,486
because this affects
everybody who flies--

362
00:14:31,656 --> 00:14:31,746
>> Yes.

363
00:14:31,876 --> 00:14:34,366
>> -- potentially, and it's
not just NASA astronauts--

364
00:14:34,366 --> 00:14:34,456
>> Mm-hmm.

365
00:14:34,456 --> 00:14:36,576
>> -- it's whoever is going
to fly in space afterwards.

366
00:14:37,056 --> 00:14:38,676
The second thing I
think as a doctor,

367
00:14:38,676 --> 00:14:39,996
is what else are we missing?

368
00:14:40,266 --> 00:14:42,126
What else have we not found yet?

369
00:14:42,796 --> 00:14:45,096
And so it makes you want
to be very aggressive

370
00:14:45,236 --> 00:14:47,546
in doing all the science;
the investigations

371
00:14:47,546 --> 00:14:49,966
on the Space Station, because
there are surely things

372
00:14:49,966 --> 00:14:52,286
that we don't know, and we
don't even understand the eye

373
00:14:52,356 --> 00:14:53,096
thing totally.

374
00:14:53,286 --> 00:14:55,866
>> I was thinking we need to
send Mike back up into space--

375
00:14:55,866 --> 00:14:56,616
>> Yes we do!

376
00:14:56,616 --> 00:14:58,116
>> -- to figure out what
the next thing is we need

377
00:14:58,116 --> 00:15:00,046
to look at, quick!

378
00:15:00,046 --> 00:15:00,606
[Laughter]

379
00:15:00,606 --> 00:15:03,636
>> But when you start talking
about deep space missions,

380
00:15:03,636 --> 00:15:07,306
maybe a year in zero gravity or
even three years out and back

381
00:15:07,416 --> 00:15:09,946
to Mars, we're going to
ratchet things up a little bit.

382
00:15:10,576 --> 00:15:14,006
And there's several tools
that we want to develop

383
00:15:14,076 --> 00:15:16,576
to be sure we know what
best counter measures

384
00:15:16,576 --> 00:15:17,546

to use for what mission.

385
00:15:18,106 --> 00:15:19,966
So, certainly, the
heavy exercise

386
00:15:19,966 --> 00:15:22,016
that we do is one of those.

387
00:15:22,276 --> 00:15:24,886
Artificial gravity is another
thing we'd like to explore

388
00:15:24,886 --> 00:15:26,256
to know when to use it;

389
00:15:26,256 --> 00:15:27,756
what kind of missions
might require it.

390
00:15:28,166 --> 00:15:33,226
So, that would be a ship that
spins, or getting into something

391
00:15:33,226 --> 00:15:36,106
that spins you for a little
while each day to put back some

392
00:15:36,106 --> 00:15:40,076
of those G-loads, some of that
gravitational load from orbit.

393
00:15:40,576 --> 00:15:43,556
Certain medications that
can actually protect.

394
00:15:43,556 --> 00:15:46,106
We're looking at those that
can actually protect the bone

395
00:15:46,166 --> 00:15:49,066
from coming apart from
softening too much.

396
00:15:49,596 --> 00:15:52,296
And our biggest problem,
is really radiation.

397
00:15:52,996 --> 00:15:55,586
And once you get out
of low Earth orbit,

398
00:15:55,586 --> 00:15:59,426
and out from under the magnetic
fields that actually help

399
00:15:59,426 --> 00:16:03,196
to shield you, then radiation
becomes bigger problems--

400
00:16:03,286 --> 00:16:06,746
a much bigger problem for us,
and so, shielding material,

401
00:16:06,806 --> 00:16:09,266
being able to fly fast to
wherever you want to go,

402
00:16:09,266 --> 00:16:10,956
spending less time
in deep space,

403
00:16:11,386 --> 00:16:13,136
that will probably be
our biggest limiter

404
00:16:13,226 --> 00:16:15,266
to how much time we
spend travelling say,

405
00:16:15,676 --> 00:16:17,356
from Earth to Mars, right.

406
00:16:17,966 --> 00:16:19,716
So, there's many
different solutions.

407
00:16:19,856 --> 00:16:21,596
One of them is just to fly fast.

408
00:16:21,976 --> 00:16:22,066
>> Yeah.

409
00:16:22,456 --> 00:16:22,546
>> So.

410
00:16:22,906 --> 00:16:26,256
>> Wow. So, and you mentioned,
like a whole arsenal of things

411
00:16:26,256 --> 00:16:29,386
that we can do to-- that
we call counter measures,

412
00:16:29,386 --> 00:16:30,386
things which will help us

413
00:16:30,446 --> 00:16:34,136
to prevent the problems,
or counteract them.

414
00:16:34,136 --> 00:16:35,176
One of the interesting ones

415
00:16:35,216 --> 00:16:37,306
that was onboard the
Space Station right now,

416

00:16:37,746 --> 00:16:42,766
is principally from
our Russian colleagues,

417
00:16:43,086 --> 00:16:43,786
the chibas [phonetic].

418
00:16:44,166 --> 00:16:44,346
>> Right.

419
00:16:44,586 --> 00:16:47,166
>> So, do you have any
experience with that on orbit?

420
00:16:47,316 --> 00:16:49,286
>> I've actually never
been in the chibas.

421
00:16:49,286 --> 00:16:51,236
I've trained to use
it as an operator,

422
00:16:51,236 --> 00:16:55,696
so a chibas is actually
a bird in Russian.

423
00:16:55,786 --> 00:16:56,916
It's the name of a bird that--

424
00:16:57,016 --> 00:16:59,386
and they name most of their
suits-- their space suits--

425
00:16:59,386 --> 00:16:59,886
>> That's right.

426
00:16:59,886 --> 00:17:01,356
>> -- after birds,
which is really cool.

427
00:17:01,916 --> 00:17:04,876
But the chibas is what's
called a lower body negative

428
00:17:05,116 --> 00:17:05,836
pressure device.

429
00:17:06,126 --> 00:17:09,566
And what that does is it seals
around your waist, and it keeps

430
00:17:09,986 --> 00:17:11,596
from your waist down
to your toes

431
00:17:11,596 --> 00:17:13,756
in a vacuum chamber,
if you will.

432
00:17:13,756 --> 00:17:13,926
[Sucking Noise]

433
00:17:13,926 --> 00:17:14,806
Yeah. It sucks.

434
00:17:14,806 --> 00:17:15,266
[Laughter]

435
00:17:15,266 --> 00:17:17,806
And so, literally, it
draws a vacuum down there,

436
00:17:17,806 --> 00:17:20,396
and all the fluids that shift
into your head all of a sudden,

437
00:17:20,646 --> 00:17:22,266
now they want to go
back down to your feet.

438
00:17:22,356 --> 00:17:24,766
So, it mimics being
on the ground again.

439
00:17:24,766 --> 00:17:25,376
Which is really cool.

440
00:17:26,186 --> 00:17:27,366
Starting in a couple weeks here,

441
00:17:27,606 --> 00:17:31,266
we'll have a U.S. crewmember
doing LBNP for the first time--

442
00:17:31,266 --> 00:17:31,496
>> Oh really?

443
00:17:31,496 --> 00:17:32,826
>> -- in about 15
years, actually.

444
00:17:32,826 --> 00:17:33,746
It's really quite amazing.

445
00:17:34,326 --> 00:17:39,936
And so, Scott Kelly, our 1-year
guy, and his counterpart,

446
00:17:39,936 --> 00:17:43,996
Mickhail Korniyenko, will both
be doing LBNP studies associated

447
00:17:43,996 --> 00:17:45,756
with the eye investigation.

448
00:17:45,876 --> 00:17:48,676
>> Yeah. I flew with both
those guys, by the way.

449
00:17:48,676 --> 00:17:48,806
[inaudible]

450
00:17:48,806 --> 00:17:48,936
[Inaudible Speaker]

451
00:17:48,936 --> 00:17:49,066
[Laughter]

452
00:17:49,066 --> 00:17:51,046
>> And this will be
pretty awesome for us,

453
00:17:51,226 --> 00:17:54,706
because we'll be able to
combine the Russian LBNP--

454
00:17:54,986 --> 00:17:55,396
>> Yeah.

455
00:17:55,496 --> 00:17:58,386
>> -- with ultrasound
and other really--

456
00:17:58,456 --> 00:18:01,256
and some of the special cameras
that we use to look at the eye,

457
00:18:01,546 --> 00:18:04,946
and so we'll get a look at the
effects of moving the fluid,

458
00:18:04,946 --> 00:18:08,026
really, the fluid shifting,
on this eye phenomenon,

459
00:18:08,146 --> 00:18:10,156
and that's one of the

big pieces to this puzzle

460
00:18:10,156 --> 00:18:11,786
that we've been waiting
for for a long time.

461
00:18:12,136 --> 00:18:13,406
>> That is really exciting.

462
00:18:13,406 --> 00:18:13,546
>> Yeah.

463
00:18:13,546 --> 00:18:17,646
>> And I'm telling you, the
amount of work that we are able

464
00:18:17,736 --> 00:18:21,236
to get accomplished in just
one six-month increment,

465
00:18:21,306 --> 00:18:25,786
which is the typical stay, for
both Mike and I, and a number

466
00:18:25,786 --> 00:18:27,106
of other colleagues we have.

467
00:18:27,646 --> 00:18:31,166
But to think about what we're
going to gain in a whole year

468
00:18:32,006 --> 00:18:37,116
from both Misha [phonetic]
and Scott is pretty exciting.

469
00:18:37,436 --> 00:18:38,136
>> Yeah. We think so.

470
00:18:38,306 --> 00:18:41,266

>> Looking forward to--
especially when they get back,

471
00:18:41,366 --> 00:18:44,146
and [inaudible] about how their
experience was personally being

472
00:18:44,146 --> 00:18:46,296
up there for a year, because
it's really just scratching the

473
00:18:46,376 --> 00:18:48,426
surface of what we hope
to do in the future

474
00:18:48,946 --> 00:18:50,546
of going further into space.

475
00:18:51,406 --> 00:18:51,906
>> Absolutely.

476
00:18:52,086 --> 00:18:52,186
>> Yeah.

477
00:18:52,216 --> 00:18:54,416
>> And I-- I'm in contact
with Scott pretty frequently,

478
00:18:54,416 --> 00:18:57,186
and I know two things are
true: He's working real hard,

479
00:18:57,186 --> 00:18:58,176
and he's having a great time.

480
00:18:58,456 --> 00:19:00,646
>> That was-- that's two of
the most important things.

481

00:19:00,646 --> 00:19:00,713
[Laughter]

482
00:19:00,713 --> 00:19:02,776
>> Right, and that's
kind of what I remember--

483
00:19:02,776 --> 00:19:02,843
[Laughter]

484
00:19:02,843 --> 00:19:03,256
>> Yeah, exactly.

485
00:19:03,256 --> 00:19:03,406
>> -- as well.

486
00:19:03,666 --> 00:19:04,366
>> Mike, thank you so much--

487
00:19:04,366 --> 00:19:05,116
>> Oh, it was my pleasure.

488
00:19:05,116 --> 00:19:06,396
>> -- for being here
on Station Life,

489
00:19:06,396 --> 00:19:08,126
and we hope to have you
back again sometime.

490
00:19:08,196 --> 00:19:08,486
>> Great.

491
00:19:09,016 --> 00:19:09,083
[Buzzing Noise]

492
00:19:09,083 --> 00:19:14,076
>> Human beings want
to go to Mars.

493
00:19:14,486 --> 00:19:17,336
>> It's a fabulous
destination for us to explore.

494
00:19:17,736 --> 00:19:21,846
It has so many scientific
questions that we could answer,

495
00:19:21,846 --> 00:19:24,086
and it might actually
be the first place

496
00:19:24,086 --> 00:19:28,646
where we find life beyond the
atmosphere of our own Earth.

497
00:19:28,796 --> 00:19:32,236
>> We're already working on
what to do when we get there,

498
00:19:32,236 --> 00:19:34,506
and how to protect the people
who will make the trip.

499
00:19:35,186 --> 00:19:37,796
>> We're doing quite
a bit now, actually,

500
00:19:37,796 --> 00:19:40,726
in many different fields:
Medical, engineering;

501
00:19:40,726 --> 00:19:43,166
social sciences, to
understand what we have

502
00:19:43,256 --> 00:19:45,466
to to send people to Mars.

503
00:19:46,056 --> 00:19:48,556
>> And much of that work
is in progress right now,

504
00:19:49,766 --> 00:19:51,936
onboard the International
Space Station.

505
00:19:52,516 --> 00:19:57,192
[Music]

506
00:19:57,692 --> 00:20:02,368
[Pause]

507
00:20:02,868 --> 00:20:07,544
[Music]

508
00:20:08,046 --> 00:20:09,746
>> Since the first
people flew in space,

509
00:20:10,116 --> 00:20:13,366
we've been studying how their
bodies react in an environment

510
00:20:13,366 --> 00:20:17,586
where everything is up in the
air because they're weightless.

511
00:20:18,386 --> 00:20:20,126
>> You may develop
motion sickness.

512
00:20:20,126 --> 00:20:23,986
You will definitely have fluid
shifts into your chest and head.

513
00:20:24,816 --> 00:20:26,106
You will lose muscle strength.

514
00:20:26,636 --> 00:20:27,976
You will lose bone strength.

515
00:20:28,496 --> 00:20:31,486
You will be receiving
radiation that we don't receive

516
00:20:31,486 --> 00:20:34,026
on the ground, and we're not
sure exactly what that will do.

517
00:20:34,556 --> 00:20:37,316
Exercise is a very
effective counter measure.

518
00:20:37,726 --> 00:20:40,936
That, coupled with drugs used
for osteoporosis have allowed

519
00:20:41,046 --> 00:20:44,666
to eliminate bone loss in
most or all of the astronauts

520
00:20:44,666 --> 00:20:47,336
that have done both the
exercise and taken the drugs,

521
00:20:47,756 --> 00:20:51,426
but there's also the isolate,
confined, extreme environment

522
00:20:51,686 --> 00:20:54,116
that the astronauts are
in, and that's a challenge

523
00:20:54,116 --> 00:20:56,856
to the psychology and mental
health and performance.

524
00:20:57,286 --> 00:21:00,656
>> On the International Space
Station, we've studied people

525
00:21:00,656 --> 00:21:03,226
in the space environment
for six months at a time.

526
00:21:03,626 --> 00:21:06,866
But a Mars mission will
take five times as long.

527
00:21:07,266 --> 00:21:09,946
>> Mars missions may take
30 months start to finish,

528
00:21:10,476 --> 00:21:12,326
so I don't think it's a bad idea

529
00:21:12,326 --> 00:21:14,366
to start getting some
longer experience

530
00:21:14,496 --> 00:21:16,726
on the International Space
Station to give us an idea

531
00:21:16,726 --> 00:21:21,036
of what's awaiting us on these
future very long flights.

532
00:21:21,856 --> 00:21:24,296
>> So the station partners
are taking the next step.

533
00:21:24,956 --> 00:21:26,966
For the first time
ever on this vehicle,

534

00:21:27,226 --> 00:21:30,766
a pair of crew members is
going to space for a year.

535
00:21:30,766 --> 00:21:33,656
>> My first flight
was very rewarding.

536
00:21:33,996 --> 00:21:36,986
There was certain
times that are fun.

537
00:21:37,056 --> 00:21:38,486
It is very challenging to live

538
00:21:38,756 --> 00:21:40,326
on the Space Station
for six months.

539
00:21:40,676 --> 00:21:42,306
If we're going to go to Mars,

540
00:21:42,556 --> 00:21:48,026
we need to understand how the
human body reacts in space

541
00:21:48,086 --> 00:21:48,976
for longer periods of time.

542
00:21:49,516 --> 00:22:06,546
[Foreign Language Spoken]

543
00:22:07,046 --> 00:22:10,266
>> Station science during this
year will continue to study bone

544
00:22:10,266 --> 00:22:13,016
and muscle weakness and
psychological effects.

545
00:22:13,016 --> 00:22:14,406
But there are new goals, too,

546
00:22:14,736 --> 00:22:17,516
like gauging how being
weightless for many,

547
00:22:17,516 --> 00:22:21,406
many months impacts fine motor
skills and restful sleep,

548
00:22:22,076 --> 00:22:24,706
and evaluating readaptation
[phonetic] to gravity.

549
00:22:25,396 --> 00:22:27,686
>> After the astronauts
land in Central Asia,

550
00:22:28,126 --> 00:22:30,496
after the 1-year mission, we'll
take them into a small tent

551
00:22:30,496 --> 00:22:32,806
and ask them to do
certain very simple

552
00:22:32,806 --> 00:22:36,136
and very routine activities
and measure how much they can

553
00:22:36,136 --> 00:22:39,186
and cannot do after the
long period of space flight.

554
00:22:39,976 --> 00:22:42,246
>> And the crew will use
equipment that's already

555

00:22:42,246 --> 00:22:45,246
on board to try to
quantify the fluid shift

556
00:22:45,546 --> 00:22:48,306
that is the prime
suspect in vision changes,

557
00:22:48,306 --> 00:22:51,816
and maybe do something about it.

558
00:22:51,816 --> 00:22:53,836
>> Wouldn't it be nice
if we could change

559
00:22:53,836 --> 00:22:56,926
that fluid distribution in space
flight, and make measurements

560
00:22:56,926 --> 00:22:59,096
of the shape of the
eye and other function,

561
00:22:59,256 --> 00:23:03,416
and see if that really is
the cause and the effect.

562
00:23:03,416 --> 00:23:05,786
>> At the same time,
Kelly and Korniyenko,

563
00:23:05,786 --> 00:23:08,106
and their crew mates, will
help with the development

564
00:23:08,106 --> 00:23:10,346
of technologies that
will need to be improved

565
00:23:10,446 --> 00:23:12,876

if future deep space
missions are to succeed.

566
00:23:12,876 --> 00:23:15,796
>> The International
Space Station is a test

567
00:23:16,016 --> 00:23:16,286
bed [phonetic].

568
00:23:16,286 --> 00:23:19,036
It allows us to test our
communications methods;

569
00:23:19,426 --> 00:23:24,866
perfect them so that we know how
to handle large delays later on.

570
00:23:24,866 --> 00:23:28,176
>> Station robotics on ISS are
developing tools that are going

571
00:23:28,286 --> 00:23:30,556
to assist crewmembers
for future missions,

572
00:23:30,556 --> 00:23:33,146
especially long duration
missions to Mars.

573
00:23:33,376 --> 00:23:34,826
We're going to assist
the crewmembers

574
00:23:34,826 --> 00:23:37,346
by having the robots do
the repetitive tasks,

575
00:23:37,346 --> 00:23:40,986
and also do the tasks that are

in the dangerous environment

576
00:23:40,986 --> 00:23:42,836
that we don't want to
subject our crewmembers to.

577
00:23:43,446 --> 00:23:45,826
>> When we go to sit down
and finally design the new--

578
00:23:46,016 --> 00:23:47,776
next generation regerative
[phonetic] life support

579
00:23:47,866 --> 00:23:50,606
for a space craft to take us
to Mars, we'll be able to draw

580
00:23:50,606 --> 00:23:52,376
on all the operational
experience we've gotten

581
00:23:52,376 --> 00:23:53,696
[phonetic] with the
space station systems

582
00:23:53,736 --> 00:23:56,026
to improve the system
and make a more reliable

583
00:23:56,556 --> 00:23:58,256
and user-friendly
system for the crew.

584
00:23:59,626 --> 00:24:01,986
>> While fostering
international cooperation

585
00:24:02,156 --> 00:24:04,576
and providing benefits to

people on Earth right now,

586
00:24:05,246 --> 00:24:08,466
and serving as a destination
for commercial vehicles

587
00:24:08,466 --> 00:24:12,766
and research, the International
Space Station is enabling future

588
00:24:12,766 --> 00:24:13,866
space exploration.

589
00:24:14,296 --> 00:24:16,866
The trip to Mars
starts right here.

590
00:24:17,516 --> 00:24:30,636
[Music]

591
00:24:31,136 --> 00:24:33,666
>> Okay. So on this
episode of Station Life,

592
00:24:33,666 --> 00:24:36,366
we learned about vision
changes in space brought

593
00:24:36,366 --> 00:24:39,006
on by the fluid shifts in
our body due to the lack

594
00:24:39,006 --> 00:24:41,886
of gravity onboard the
International Space Station.

595
00:24:41,886 --> 00:24:44,556
We also learned how we're
studying this phenomenon

596
00:24:44,796 --> 00:24:47,126
and what we're doing about it.

597
00:24:47,126 --> 00:24:49,516
This vision research
provides insight

598
00:24:49,516 --> 00:24:52,476
into the structural changes
that can occur in both the eyes

599
00:24:52,476 --> 00:24:54,026
and the central nervous system,

600
00:24:54,206 --> 00:24:56,826
which can be relevant patients
here on Earth suffering

601
00:24:56,826 --> 00:25:00,786
from a wide range of ocular
diseases such as glaucoma.

602
00:25:00,786 --> 00:25:04,066
As you can see, research
onboard the ISS continues

603
00:25:04,066 --> 00:25:07,796
to benefit us all here on Earth,
so be sure to stay in touch

604
00:25:07,796 --> 00:25:09,456
and follow us on
Facebook and Twitter

605
00:25:09,536 --> 00:25:12,266
for the latest research
news, and do not forget

606
00:25:12,266 --> 00:25:14,426

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