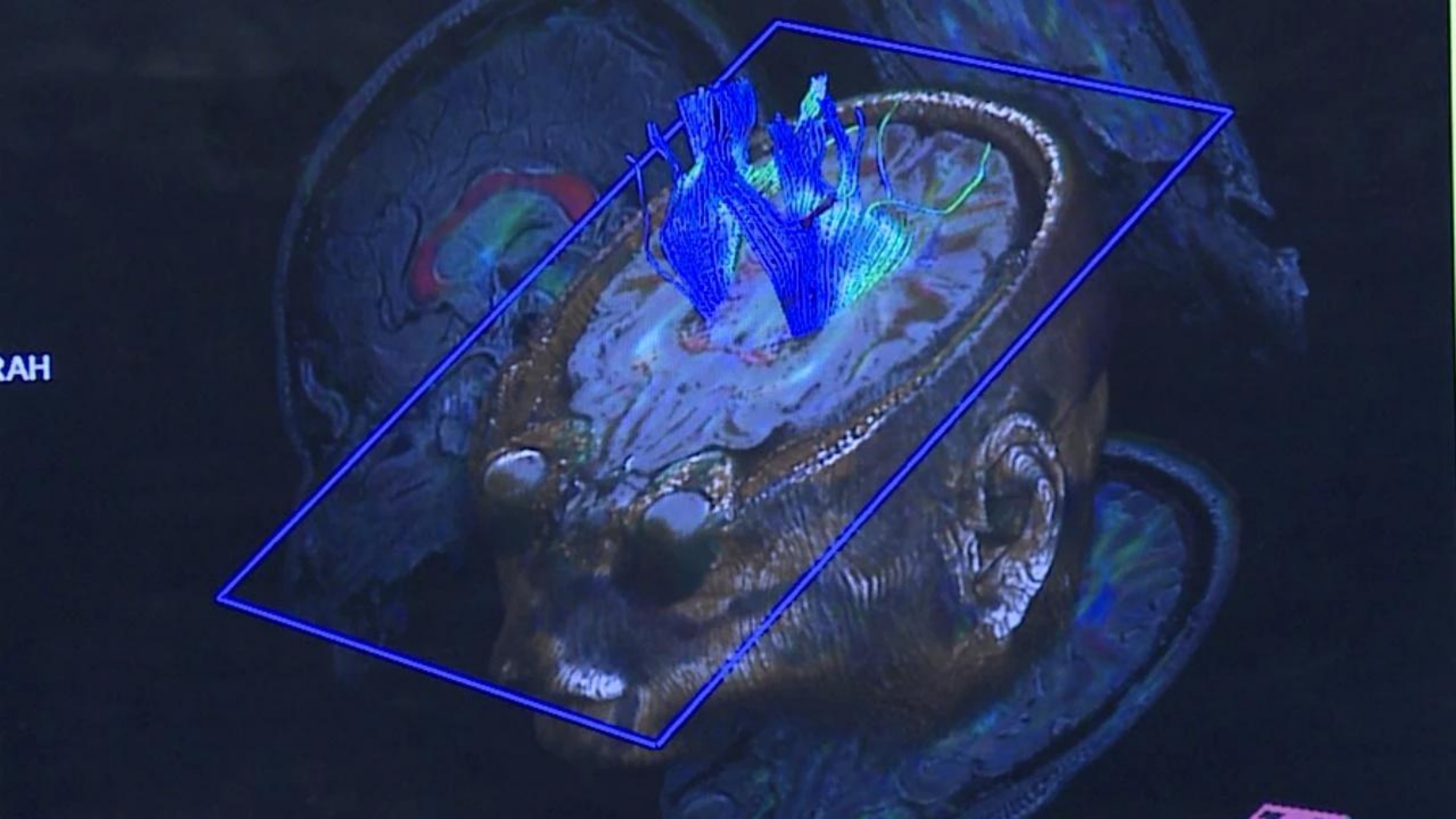
RAH

1
00:00:03,669 --> 00:00:02,070
we're here at the university of texas

2
00:00:05,510 --> 00:00:03,679
medical branch specialty care center

3
00:00:07,430 --> 00:00:05,520
which is in league city just south of

4
00:00:10,070 --> 00:00:07,440
johnson space center and we're joining

5
00:00:11,749 --> 00:00:10,080
today dr roy viaskos who is one of the

6
00:00:13,589 --> 00:00:11,759
many doctors looking at the changes that

7
00:00:15,669 --> 00:00:13,599
astronauts experience in their eyesight

8
00:00:17,830 --> 00:00:15,679
when they're in space he in particular

9
00:00:19,029 --> 00:00:17,840
has been looking to using mri to track

10
00:00:20,310 --> 00:00:19,039
those changes and he's going to tell us

11
00:00:21,990 --> 00:00:20,320
a little bit about that today thanks so

12
00:00:23,830 --> 00:00:22,000
much for joining us thank you so much

13
00:00:25,990 --> 00:00:23,840

for having me here all right well why

14
00:00:28,150 --> 00:00:26,000
don't we start with why would you use an

15
00:00:31,349 --> 00:00:28,160
mri to look at eyes

16
00:00:33,990 --> 00:00:31,359
well so mri is modern technology

17
00:00:35,030 --> 00:00:34,000
that allows us to look at the anatomy of

18
00:00:35,990 --> 00:00:35,040
the body

19
00:00:38,470 --> 00:00:36,000
using

20
00:00:40,389 --> 00:00:38,480
magnetism

21
00:00:42,709 --> 00:00:40,399
the eyes are

22
00:00:45,110 --> 00:00:42,719
structures that have a lot of fluid in

23
00:00:47,670 --> 00:00:45,120
them and mri is really good to look at

24
00:00:49,830 --> 00:00:47,680
structures that have fluid

25
00:00:52,709 --> 00:00:49,840
since the astronauts have had problems

26
00:00:55,590 --> 00:00:52,719
with their visual fields mri now allows

27
00:00:58,229 --> 00:00:55,600
us using modern technology to have very

28
00:01:00,389 --> 00:00:58,239
high resolution imaging of the orbits

29
00:01:01,990 --> 00:01:00,399
and of the eyes we are actually using

30
00:01:03,990 --> 00:01:02,000
doing scans that go through the eyes of

31
00:01:07,510 --> 00:01:04,000
the astronauts that

32
00:01:09,270 --> 00:01:07,520
are less than 0.6 millimeters in size

33
00:01:11,270 --> 00:01:09,280
each of the dots that make up for the

34
00:01:13,270 --> 00:01:11,280
image

35
00:01:15,350 --> 00:01:13,280
and this will allow us to actually

36
00:01:18,710 --> 00:01:15,360
follow and check out things that would

37
00:01:21,510 --> 00:01:18,720
happen macroscopically inside of an eye

38
00:01:23,350 --> 00:01:21,520

so and in the optic nerve that goes

39
00:01:25,910 --> 00:01:23,360
behind it for those of us who don't know

40
00:01:30,149 --> 00:01:25,920
what exactly is an orbit okay so

41
00:01:33,270 --> 00:01:30,159
basically the face has two big cavities

42
00:01:35,749 --> 00:01:33,280
uh that are to just hold the eyes in

43
00:01:37,590 --> 00:01:35,759
right so we call those the orbits so

44
00:01:39,030 --> 00:01:37,600
you've been doing this for a while now i

45
00:01:40,630 --> 00:01:39,040
think you started with the the last

46
00:01:42,069 --> 00:01:40,640
three of the shuttle missions have you

47
00:01:44,630 --> 00:01:42,079
been able to get some good data from

48
00:01:45,990 --> 00:01:44,640
them yes so we have been doing using mri

49
00:01:47,749 --> 00:01:46,000
on the astronauts

50
00:01:49,190 --> 00:01:47,759
for around

51
00:01:51,830 --> 00:01:49,200
eight years

52
00:01:54,469 --> 00:01:51,840
um here um the new experiment that we

53
00:01:56,550 --> 00:01:54,479
started with the veip started five years

54
00:01:57,670 --> 00:01:56,560
ago okay and uh

55
00:02:00,149 --> 00:01:57,680
we did

56
00:02:02,069 --> 00:02:00,159
the last three shuttle missions here and

57
00:02:03,510 --> 00:02:02,079
then all the soyuz project so i guess

58
00:02:06,069 --> 00:02:03,520
you've gathered a lot of data is it

59
00:02:08,389 --> 00:02:06,079
helpful data well the the main thing

60
00:02:09,669 --> 00:02:08,399
that we do with the data is we do

61
00:02:12,550 --> 00:02:09,679
a clinical

62
00:02:14,470 --> 00:02:12,560
read of the mri just like we would for

63
00:02:15,589 --> 00:02:14,480

the brain of any subject that came into

64
00:02:17,430 --> 00:02:15,599
the magnet

65
00:02:18,790 --> 00:02:17,440
the additional information that we get

66
00:02:20,390 --> 00:02:18,800
out of the study

67
00:02:22,949 --> 00:02:20,400
is being analyzed right now and it's

68
00:02:24,790 --> 00:02:22,959
part of research what exactly are you

69
00:02:26,949 --> 00:02:24,800
looking for in the data

70
00:02:28,550 --> 00:02:26,959
so the data that we get from the

71
00:02:31,270 --> 00:02:28,560
astronauts

72
00:02:34,550 --> 00:02:31,280
we have we scan the brains

73
00:02:37,910 --> 00:02:34,560
so we get to see how the brain looks we

74
00:02:40,550 --> 00:02:37,920
also get to scan the orbits just like we

75
00:02:44,150 --> 00:02:40,560
discussed and the orbits will find how

76
00:02:46,309 --> 00:02:44,160
the eye looks and how the optic nerve is

77
00:02:48,229 --> 00:02:46,319
the optic nerve connects the eye with

78
00:02:50,390 --> 00:02:48,239
the brain and then there's a sheath

79
00:02:52,309 --> 00:02:50,400
around the optic nerve that we also look

80
00:02:53,910 --> 00:02:52,319
at because we have seen changes in

81
00:02:55,030 --> 00:02:53,920
astronauts before and after they come

82
00:02:58,550 --> 00:02:55,040
from space

83
00:03:00,630 --> 00:02:58,560
and not only the optic globe but also in

84
00:03:02,630 --> 00:03:00,640
the optic nerve and in the optic nerve

85
00:03:04,390 --> 00:03:02,640
sheath you're looking at the optic nerve

86
00:03:07,190 --> 00:03:04,400
sheath thin is it getting smaller or

87
00:03:09,990 --> 00:03:07,200
bigger some of the astronauts

88
00:03:11,270 --> 00:03:10,000

have shown to have a distended optic

89
00:03:13,030 --> 00:03:11,280
nerve sheath

90
00:03:15,190 --> 00:03:13,040
and also the optic nerve becomes a

91
00:03:17,589 --> 00:03:15,200
little bit more torturous okay at the

92
00:03:19,030 --> 00:03:17,599
same time there's some flattening of the

93
00:03:21,030 --> 00:03:19,040
back of the eye

94
00:03:23,430 --> 00:03:21,040
and that especially true in the ones

95
00:03:25,270 --> 00:03:23,440
that have had visual changes what

96
00:03:27,589 --> 00:03:25,280
exactly does the sheath control

97
00:03:30,470 --> 00:03:27,599
we we really do not know that that is a

98
00:03:33,110 --> 00:03:30,480
great question we know that that all of

99
00:03:36,070 --> 00:03:33,120
these are a result of changes possibly

100
00:03:37,430 --> 00:03:36,080
of pressures of the whole system one of

101
00:03:39,270 --> 00:03:37,440
the important things to understand is

102
00:03:41,750 --> 00:03:39,280
that the eyes are actually actually not

103
00:03:44,470 --> 00:03:41,760
nerves they're really extensions of the

104
00:03:47,830 --> 00:03:44,480
brain okay so when the optic nerve

105
00:03:50,229 --> 00:03:47,840
sheath distends it could be also that

106
00:03:50,949 --> 00:03:50,239
the pressure inside of the membranes

107
00:03:53,589 --> 00:03:50,959
that

108
00:03:55,270 --> 00:03:53,599
cover the brain is increasing

109
00:03:56,710 --> 00:03:55,280
so that could be one of the causes of

110
00:03:58,309 --> 00:03:56,720
the changes that we are seeing and we're

111
00:04:00,229 --> 00:03:58,319
actually exploring that all right so

112
00:04:03,190 --> 00:04:00,239
what exactly is this behind us this is

113
00:04:05,830 --> 00:04:03,200

the mri right so this is an mri machine

114
00:04:08,390 --> 00:04:05,840
the mri machine is a what where you're

115
00:04:11,589 --> 00:04:08,400
seeing here is a huge magnet so right

116
00:04:13,509 --> 00:04:11,599
now this magnet produces 60 000 times

117
00:04:16,390 --> 00:04:13,519
the magnetism of the earth

118
00:04:19,349 --> 00:04:16,400
so we use that to actually align the

119
00:04:21,909 --> 00:04:19,359
atoms of in the body as the body goes in

120
00:04:23,990 --> 00:04:21,919
there and once we have aligned all the

121
00:04:25,430 --> 00:04:24,000
atoms we choose the atom that is the

122
00:04:27,909 --> 00:04:25,440
most frequent one

123
00:04:29,990 --> 00:04:27,919
in the whole body which is hydrogen

124
00:04:32,230 --> 00:04:30,000
right we then

125
00:04:34,469 --> 00:04:32,240
are we're able to make all the hydrogen

126
00:04:36,629 --> 00:04:34,479
atoms kind of dance

127
00:04:40,150 --> 00:04:36,639
to the same magnetic vector because of

128
00:04:42,550 --> 00:04:40,160
the huge magnetism and we kind of tilt

129
00:04:45,830 --> 00:04:42,560
those mag those that magnetic vector

130
00:04:48,550 --> 00:04:45,840
using radio frequencies we transfer

131
00:04:50,629 --> 00:04:48,560
energy to those atoms and they tilt and

132
00:04:51,749 --> 00:04:50,639
once we take the radio frequency out

133
00:04:53,990 --> 00:04:51,759
they want

134
00:04:56,230 --> 00:04:54,000
to stand up again to the same magnetic

135
00:04:59,030 --> 00:04:56,240
field and they'll liberate that energy

136
00:05:01,350 --> 00:04:59,040
okay and then we use basically antennas

137
00:05:03,029 --> 00:05:01,360
to detect that energy that's liberated

138
00:05:04,469 --> 00:05:03,039

and tweak it a little bit to get an

139
00:05:06,629 --> 00:05:04,479
image so you get images of the

140
00:05:09,830 --> 00:05:06,639
astronauts uh once before flight and

141
00:05:10,950 --> 00:05:09,840
once after right yes so we

142
00:05:14,469 --> 00:05:10,960
usually

143
00:05:16,070 --> 00:05:14,479
do an mri just before they go into the

144
00:05:18,469 --> 00:05:16,080
mission

145
00:05:20,310 --> 00:05:18,479
and we try to put them into the magnet

146
00:05:21,749 --> 00:05:20,320
in the first three days after they come

147
00:05:23,909 --> 00:05:21,759
back to earth

148
00:05:26,790 --> 00:05:23,919
and the reason to that is we really want

149
00:05:28,469 --> 00:05:26,800
to be able to detect changes as soon as

150
00:05:31,670 --> 00:05:28,479
they happen before

151
00:05:33,110 --> 00:05:31,680
the gravity of earth changes or reverts

152
00:05:35,510 --> 00:05:33,120
any of the changes that could have

153
00:05:37,590 --> 00:05:35,520
happened in space have you been able to

154
00:05:40,469 --> 00:05:37,600
draw any conclusions from all this so

155
00:05:41,590 --> 00:05:40,479
far what we have seen is that

156
00:05:43,590 --> 00:05:41,600
some of the

157
00:05:44,710 --> 00:05:43,600
changes that we have identified in the

158
00:05:46,870 --> 00:05:44,720
orbits

159
00:05:48,710 --> 00:05:46,880
are similar to changes that we see in

160
00:05:50,310 --> 00:05:48,720
terrestrials that have increased

161
00:05:52,070 --> 00:05:50,320
intracranial pressure

162
00:05:53,990 --> 00:05:52,080
and that is one of the things that we

163
00:05:56,550 --> 00:05:54,000

really want to concentrate our efforts

164
00:05:59,430 --> 00:05:56,560
right now is to make sure

165
00:06:00,710 --> 00:05:59,440
or we want to know what is the cause of

166
00:06:02,629 --> 00:06:00,720
all these changes that we have seen in

167
00:06:04,150 --> 00:06:02,639
the orbits and our goal is to identify

168
00:06:06,070 --> 00:06:04,160
countermeasures and

169
00:06:08,150 --> 00:06:06,080
hopefully this could be yes this could

170
00:06:10,309 --> 00:06:08,160
be related then to because we

171
00:06:12,150 --> 00:06:10,319
transferred to counter measures that we

172
00:06:14,870 --> 00:06:12,160
can take to avoid this from happening

173
00:06:17,029 --> 00:06:14,880
again okay so so what do you do with the

174
00:06:18,390 --> 00:06:17,039
mri okay so with the mri

175
00:06:19,270 --> 00:06:18,400
what we do is

176
00:06:20,950 --> 00:06:19,280
we

177
00:06:24,469 --> 00:06:20,960
scan the brain

178
00:06:26,950 --> 00:06:24,479
we look

179
00:06:29,189 --> 00:06:26,960
at the big picture of the brain of the

180
00:06:30,070 --> 00:06:29,199
astronauts that's called the macroscopic

181
00:06:32,150 --> 00:06:30,080
brain

182
00:06:33,430 --> 00:06:32,160
at the same time we are going to scan

183
00:06:40,870 --> 00:06:33,440
the orbits

184
00:06:43,430 --> 00:06:40,880
use a much higher resolution to look at

185
00:06:45,830 --> 00:06:43,440
the orbits and we can really see very

186
00:06:48,629 --> 00:06:45,840
small details and i was explaining to

187
00:06:50,790 --> 00:06:48,639
you last time those details can be

188
00:06:53,110 --> 00:06:50,800

up to 0.6 millimeters

189
00:06:55,909 --> 00:06:53,120
in in small changes that we can detect

190
00:06:58,629 --> 00:06:55,919
with the mri but the interesting thing

191
00:07:00,550 --> 00:06:58,639
is that with the mri we don't only see

192
00:07:03,350 --> 00:07:00,560
macroscopic changes

193
00:07:05,830 --> 00:07:03,360
we can also detect microscopic changes

194
00:07:09,350 --> 00:07:05,840
of the hydrogen within the brain

195
00:07:11,990 --> 00:07:09,360
so one of the things that we do is we do

196
00:07:14,629 --> 00:07:12,000
we actually diffuse the water molecules

197
00:07:16,710 --> 00:07:14,639
within the astronauts brain by using

198
00:07:18,309 --> 00:07:16,720
what we call gradients

199
00:07:20,309 --> 00:07:18,319
and that type of imaging is called

200
00:07:22,790 --> 00:07:20,319
diffusion tensor imaging

201
00:07:25,110 --> 00:07:22,800
and it will give us information

202
00:07:27,029 --> 00:07:25,120
about the microstructure of the brain

203
00:07:28,870 --> 00:07:27,039
and the the water within the brain

204
00:07:31,270 --> 00:07:28,880
things that we cannot see with our naked

205
00:07:34,150 --> 00:07:31,280
eye but it will actually give us

206
00:07:36,550 --> 00:07:34,160
function and we can map all the fiber

207
00:07:38,790 --> 00:07:36,560
tracks within the white matter

208
00:07:40,550 --> 00:07:38,800
and we can see if there make microscopic

209
00:07:43,430 --> 00:07:40,560
changes within it

210
00:07:45,830 --> 00:07:43,440
a third great thing that we do is that

211
00:07:48,869 --> 00:07:45,840
we're able to also see flows

212
00:07:52,230 --> 00:07:48,879
and by seeing flows we expect to

213
00:07:54,629 --> 00:07:52,240

quantify those flows and possibly be

214
00:07:57,110 --> 00:07:54,639
able to have an indirect way of

215
00:07:58,950 --> 00:07:57,120
measuring intracranial pressure okay so

216
00:08:00,950 --> 00:07:58,960
if increased intracranial pressure could

217
00:08:03,029 --> 00:08:00,960
be one of the causes

218
00:08:06,710 --> 00:08:03,039
of the findings that we're seeing

219
00:08:09,350 --> 00:08:06,720
then through mri we expect to be able to

220
00:08:12,950 --> 00:08:09,360
have a relaxed correlation between the

221
00:08:15,110 --> 00:08:12,960
imaging findings through flows and

222
00:08:16,710 --> 00:08:15,120
intracranial pressure changes so you've

223
00:08:18,390 --> 00:08:16,720
seen a lot of astronaut eyes you want to

224
00:08:20,150 --> 00:08:18,400
take a look at mine now sure why don't

225
00:08:22,469 --> 00:08:20,160
you take a seat all right and keith will

226
00:08:27,589 --> 00:08:22,479
help us out okay

227
00:08:31,270 --> 00:08:29,110
okay

228
00:08:34,389 --> 00:08:31,280
i'll put the head coil on now

229
00:08:36,870 --> 00:08:34,399
okay what is this this here is a uh it's

230
00:08:38,709 --> 00:08:36,880
a coil this is basically a fancy antenna

231
00:08:55,030 --> 00:08:38,719
that takes the pictures of the inside of

232
00:08:58,550 --> 00:08:56,630
all right

233
00:09:00,470 --> 00:08:58,560
so any instructions

234
00:09:02,630 --> 00:09:00,480
ah the only instructions at this point

235
00:09:10,550 --> 00:09:02,640
are just try your best not to move

236
00:09:14,550 --> 00:09:12,150
okay so what we're looking for when

237
00:09:17,190 --> 00:09:14,560
we're looking at an a patient in a

238
00:09:18,470 --> 00:09:17,200

magnet like brandy especially when it is

239
00:09:20,150 --> 00:09:18,480
an astronaut

240
00:09:22,790 --> 00:09:20,160
is at the brain

241
00:09:24,310 --> 00:09:22,800
here you can see the head and in the

242
00:09:26,070 --> 00:09:24,320
middle you have the brain

243
00:09:28,070 --> 00:09:26,080
and we can scroll

244
00:09:28,949 --> 00:09:28,080
and see all the structures inside of the

245
00:09:31,030 --> 00:09:28,959
brain

246
00:09:32,630 --> 00:09:31,040
you can see the white matter

247
00:09:35,829 --> 00:09:32,640
and the cortex

248
00:09:37,509 --> 00:09:35,839
we can also see the eyes and this is

249
00:09:39,750 --> 00:09:37,519
especially something very important for

250
00:09:41,910 --> 00:09:39,760
this project and in the eyes we can look

251
00:09:43,670 --> 00:09:41,920
at the eye globes you can see here

252
00:09:46,790 --> 00:09:43,680
the eye globe and this is the lens

253
00:09:51,670 --> 00:09:48,949
as we scroll down you can see that the

254
00:09:54,150 --> 00:09:51,680
eye is connected posteriorly with

255
00:09:56,470 --> 00:09:54,160
the optic nerve and this structure that

256
00:09:58,470 --> 00:09:56,480
we have right surrounding the optic

257
00:10:02,230 --> 00:09:58,480
nerve is the optic nerve sheath that we

258
00:10:05,590 --> 00:10:03,110
okay