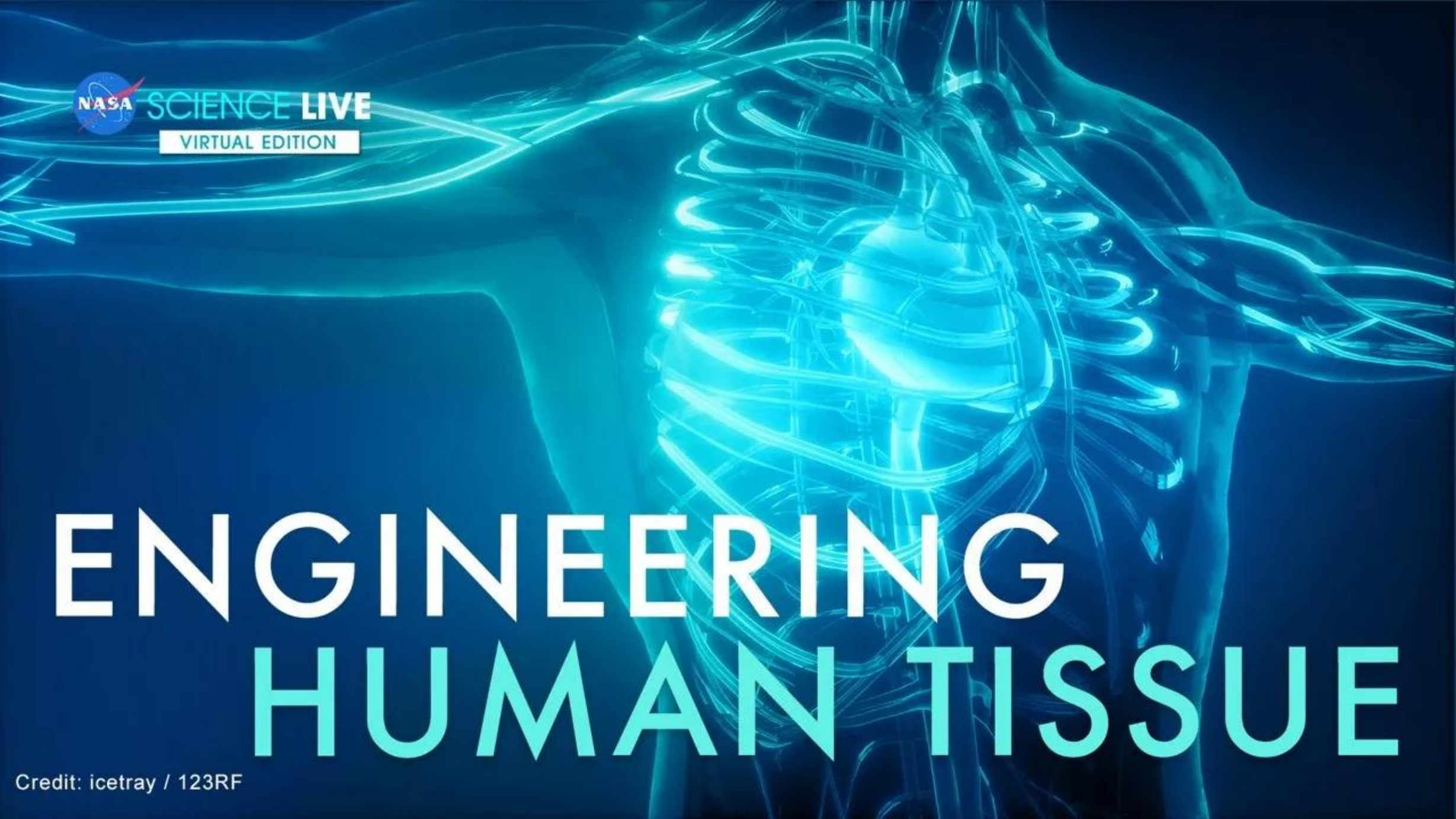
NASA
SCIENCE LIVE
VIRTUAL EDITION
ENGINEERING
HUMAN TISSUE
Credit: icetray / 123RF

1
00:00:56,830 --> 00:00:44,150
[Music]

2
00:00:57,990 --> 00:00:56,840
[Applause]

3
00:01:15,670 --> 00:00:58,000
so

4
00:01:20,070 --> 00:01:17,910
hello and welcome to another virtual

5
00:01:22,630 --> 00:01:20,080
episode of nasa science live

6
00:01:25,190 --> 00:01:22,640
i'm your host lauren ward and today we

7
00:01:26,870 --> 00:01:25,200
have some very exciting news for you

8
00:01:30,550 --> 00:01:26,880
scientists have created thick

9
00:01:32,550 --> 00:01:30,560
vascularized human organ tissue in a lab

10
00:01:33,910 --> 00:01:32,560
these are the first revolutionary steps

11
00:01:36,550 --> 00:01:33,920
to 3d printing

12
00:01:37,590 --> 00:01:36,560
functional human organs so you may be

13
00:01:39,590 --> 00:01:37,600

thinking

14
00:01:41,429 --> 00:01:39,600
what does nasa have to do with this and

15
00:01:43,190 --> 00:01:41,439
why is it such a big deal

16
00:01:44,789 --> 00:01:43,200
stay tuned because today you're going to

17
00:01:48,230 --> 00:01:44,799
find out all about this

18
00:01:50,469 --> 00:01:48,240
and more it will have an enormous impact

19
00:01:51,670 --> 00:01:50,479
on humankind it can really change the

20
00:01:53,590 --> 00:01:51,680
face of medicine

21
00:01:55,109 --> 00:01:53,600
as we know it the vascular tissue

22
00:01:56,870 --> 00:01:55,119
challenge aims to

23
00:01:58,230 --> 00:01:56,880
tackle one of the most fundamental

24
00:01:59,590 --> 00:01:58,240
problems in the field of tissue

25
00:02:00,149 --> 00:01:59,600
engineering the vascular tissue

26
00:02:03,830 --> 00:02:00,159
challenge

27
00:02:05,109 --> 00:02:03,840
that's given to the first three teams

28
00:02:07,670 --> 00:02:05,119
that are able to create

29
00:02:08,389 --> 00:02:07,680
vascularized tissue that is to say

30
00:02:10,630 --> 00:02:08,399
tissue

31
00:02:11,670 --> 00:02:10,640
with its own blood vessels so that we

32
00:02:13,750 --> 00:02:11,680
can actually grow

33
00:02:15,110 --> 00:02:13,760
complex tissues that are required for

34
00:02:17,350 --> 00:02:15,120
whole organ development

35
00:02:19,589 --> 00:02:17,360
people can make veins people can make

36
00:02:20,630 --> 00:02:19,599
arteries but no one can put all of it

37
00:02:23,670 --> 00:02:20,640
together a huge

38
00:02:25,430 --> 00:02:23,680

challenge is to ensure that this tissue

39
00:02:27,510 --> 00:02:25,440
functions we need to be able to get

40
00:02:29,830 --> 00:02:27,520
nutrients in and get waste products out

41
00:02:31,670 --> 00:02:29,840
there needs to be a blood supply so

42
00:02:32,710 --> 00:02:31,680
centennial challenge is a really unique

43
00:02:34,710 --> 00:02:32,720
way of tackling

44
00:02:36,229 --> 00:02:34,720
certain problems because of the capacity

45
00:02:38,229 --> 00:02:36,239
to revolutionize

46
00:02:40,390 --> 00:02:38,239
organ transplantation tissue

47
00:02:43,170 --> 00:02:40,400
regeneration we can make a difference

48
00:02:45,270 --> 00:02:43,180
both on earth and in space

49
00:02:47,110 --> 00:02:45,280
[Music]

50
00:02:49,350 --> 00:02:47,120
teams across the country have been

51
00:02:50,070 --> 00:02:49,360
competing for years to be the first to

52
00:02:52,630 --> 00:02:50,080
engineer

53
00:02:54,229 --> 00:02:52,640
functional human tissue and today we're

54
00:02:54,869 --> 00:02:54,239
going to announce the official winner of

55
00:02:57,670 --> 00:02:54,879
nasa's

56
00:02:59,270 --> 00:02:57,680
vascular tissue challenge here to talk

57
00:03:00,070 --> 00:02:59,280
more about the challenge is monsieur

58
00:03:02,550 --> 00:03:00,080
rahman

59
00:03:03,670 --> 00:03:02,560
the program manager of nasa's centennial

60
00:03:05,350 --> 00:03:03,680
challenges

61
00:03:07,910 --> 00:03:05,360
monsie thank you so much for joining us

62
00:03:08,390 --> 00:03:07,920
today thank you lauren for having me

63
00:03:11,509 --> 00:03:08,400

today

64
00:03:14,070 --> 00:03:11,519
i am so excited to talk about the winner

65
00:03:15,430 --> 00:03:14,080
and what we're doing yeah there is a lot

66
00:03:18,630 --> 00:03:15,440
to be excited about

67
00:03:21,509 --> 00:03:18,640
um okay basics what is the vascular

68
00:03:22,309 --> 00:03:21,519
tissue challenge all about the vascular

69
00:03:24,390 --> 00:03:22,319
tissue challenge

70
00:03:25,670 --> 00:03:24,400
is about incentivizing the public to

71
00:03:29,589 --> 00:03:25,680
help us develop

72
00:03:33,110 --> 00:03:29,599
thick functional tissue from major human

73
00:03:35,990 --> 00:03:33,120
organs that can one day perhaps help us

74
00:03:37,270 --> 00:03:36,000
achieve long duration missions keep our

75
00:03:41,350 --> 00:03:37,280
astronauts healthy

76
00:03:44,789 --> 00:03:41,360
and also have amazing earth applications

77
00:03:46,470 --> 00:03:44,799
amazing that sounds great to me why is

78
00:03:48,070 --> 00:03:46,480
nasa interested in this sort of

79
00:03:49,350 --> 00:03:48,080
revolutionary technology you touched on

80
00:03:50,710 --> 00:03:49,360
it a little bit but let's go a little

81
00:03:53,030 --> 00:03:50,720
bit deeper

82
00:03:55,030 --> 00:03:53,040
so nasa is super interested in this for

83
00:03:55,670 --> 00:03:55,040
very many different reasons so the first

84
00:03:58,309 --> 00:03:55,680
one

85
00:03:58,949 --> 00:03:58,319
short term would be the possibility of

86
00:04:02,309 --> 00:03:58,959
help

87
00:04:04,390 --> 00:04:02,319
incentivize the commercialization of

88
00:04:06,470 --> 00:04:04,400

the international space station by

89
00:04:08,869 --> 00:04:06,480
allowing companies to perhaps

90
00:04:10,149 --> 00:04:08,879
create tissues for humans on earth that

91
00:04:11,830 --> 00:04:10,159
need a little bit of help

92
00:04:14,229 --> 00:04:11,840
with their organs that might be not

93
00:04:16,629 --> 00:04:14,239
functioning a hundred percent

94
00:04:18,629 --> 00:04:16,639
but in the long run uh we are looking at

95
00:04:21,749 --> 00:04:18,639
these kinds of technologies to help us

96
00:04:23,670 --> 00:04:21,759
understand the effects of radiation

97
00:04:25,909 --> 00:04:23,680
on the human body without using human

98
00:04:28,790 --> 00:04:25,919
bodies using you know tissues

99
00:04:30,710 --> 00:04:28,800
and then long long long term after that

100
00:04:31,430 --> 00:04:30,720
possibly to help us maintain the health

101
00:04:34,629 --> 00:04:31,440
of our crew

102
00:04:37,990 --> 00:04:34,639
when we go to mars and beyond wow

103
00:04:38,310 --> 00:04:38,000
that's amazing um so i understand this

104
00:04:40,830 --> 00:04:38,320
is

105
00:04:42,310 --> 00:04:40,840
just one of many prize competitions at

106
00:04:45,830 --> 00:04:42,320
nasa why

107
00:04:48,150 --> 00:04:45,840
challenges oh my goodness

108
00:04:49,350 --> 00:04:48,160
challenges are amazing it is a way to

109
00:04:52,550 --> 00:04:49,360
involve the public

110
00:04:54,390 --> 00:04:52,560
in the nasa mission and allows people

111
00:04:56,950 --> 00:04:54,400
that perhaps have never thought about

112
00:04:57,670 --> 00:04:56,960
competing or about being part of the

113
00:05:00,150 --> 00:04:57,680

nasa

114
00:05:01,749 --> 00:05:00,160
groups to be part of our group we have

115
00:05:04,550 --> 00:05:01,759
had an incredible

116
00:05:05,749 --> 00:05:04,560
success with people that have never ever

117
00:05:08,150 --> 00:05:05,759
even dreamed about

118
00:05:10,150 --> 00:05:08,160
contributing to the nasa mission and

119
00:05:11,830 --> 00:05:10,160
challenges our way of doing that

120
00:05:13,909 --> 00:05:11,840
it's a way for us to tell you what our

121
00:05:15,990 --> 00:05:13,919
problems are our issues are

122
00:05:17,510 --> 00:05:16,000
our technology gaps and for the public

123
00:05:18,710 --> 00:05:17,520
to come back and tell us

124
00:05:21,270 --> 00:05:18,720
you know the amazing things they're

125
00:05:23,350 --> 00:05:21,280
doing and how their technologies can

126
00:05:26,469 --> 00:05:23,360
help us

127
00:05:28,230 --> 00:05:26,479
wow that is incredible stuff um

128
00:05:30,150 --> 00:05:28,240
thank you so much for joining us today

129
00:05:32,230 --> 00:05:30,160
monty

130
00:05:35,029 --> 00:05:32,240
you're welcome thank you for having us

131
00:05:37,270 --> 00:05:35,039
and we're super excited

132
00:05:38,390 --> 00:05:37,280
so solving the vascular tissue challenge

133
00:05:40,950 --> 00:05:38,400
will have a huge

134
00:05:42,390 --> 00:05:40,960
impact on nasa's long-term goals but it

135
00:05:44,710 --> 00:05:42,400
can also have an impact

136
00:05:46,230 --> 00:05:44,720
on those of us here on earth the

137
00:05:48,469 --> 00:05:46,240
vascular tissue challenge

138
00:05:49,749 --> 00:05:48,479

wants to make a piece of tissue

139
00:05:51,749 --> 00:05:49,759
vascularized tissue

140
00:05:53,670 --> 00:05:51,759
is a composite type of tissue it has

141
00:05:55,189 --> 00:05:53,680
more than one sort of cell in it

142
00:05:56,790 --> 00:05:55,199
there needs to be blood vessels

143
00:05:58,230 --> 00:05:56,800
throughout this tissue that are

144
00:06:00,790 --> 00:05:58,240
integrated fully with

145
00:06:02,309 --> 00:06:00,800
the organ tissue we've seen some great

146
00:06:03,830 --> 00:06:02,319
successes in the development of tissue

147
00:06:05,950 --> 00:06:03,840
engineering products we are

148
00:06:07,110 --> 00:06:05,960
making some progress with regard to

149
00:06:09,110 --> 00:06:07,120
vascularization

150
00:06:10,790 --> 00:06:09,120
we're beginning to understand the

151
00:06:13,430 --> 00:06:10,800
signals that are necessary

152
00:06:14,230 --> 00:06:13,440
to switch on cells to become blood

153
00:06:16,629 --> 00:06:14,240
vessels

154
00:06:18,390 --> 00:06:16,639
if we could create vascularized tissue

155
00:06:20,070 --> 00:06:18,400
we could create whole organs

156
00:06:21,590 --> 00:06:20,080
in order to successfully grow whole

157
00:06:23,430 --> 00:06:21,600
organs it'll be essential that we

158
00:06:25,909 --> 00:06:23,440
further develop these technologies

159
00:06:26,710 --> 00:06:25,919
putting all those together is really the

160
00:06:28,469 --> 00:06:26,720
holy grail

161
00:06:30,230 --> 00:06:28,479
that's what we're looking to do the

162
00:06:32,950 --> 00:06:30,240
vascular tissue challenge

163
00:06:34,230 --> 00:06:32,960

is an essential step that will help to

164
00:06:38,230 --> 00:06:34,240
address that issue

165
00:06:41,830 --> 00:06:40,150
to help us understand the significant

166
00:06:43,990 --> 00:06:41,840
impacts this challenge will have on the

167
00:06:47,029 --> 00:06:44,000
scientific and medical communities

168
00:06:48,150 --> 00:06:47,039
we are joined by dr arun sharma vascular

169
00:06:50,150 --> 00:06:48,160
tissue challenge judge

170
00:06:51,189 --> 00:06:50,160
and a research fellow at cedars-sinai

171
00:06:53,830 --> 00:06:51,199
medical center

172
00:06:55,589 --> 00:06:53,840
thank you so much for joining us today

173
00:06:58,150 --> 00:06:55,599
thank you for having me

174
00:06:59,350 --> 00:06:58,160
okay one thing i you know we i think we

175
00:07:01,990 --> 00:06:59,360
should clear up here

176
00:07:03,110 --> 00:07:02,000
is can you explain exactly what

177
00:07:06,390 --> 00:07:03,120
vascularized

178
00:07:09,749 --> 00:07:06,400
tissue is sure i'd love to

179
00:07:12,469 --> 00:07:09,759
vascularize tissue in the simplest term

180
00:07:13,270 --> 00:07:12,479
is tissue that has blood vessels and the

181
00:07:15,029 --> 00:07:13,280
reality is

182
00:07:16,309 --> 00:07:15,039
all the tissues in our body are

183
00:07:18,870 --> 00:07:16,319
comprised of

184
00:07:20,790 --> 00:07:18,880
many many blood vessels so if we want to

185
00:07:23,830 --> 00:07:20,800
better understand

186
00:07:24,950 --> 00:07:23,840
how the human body is functioning we

187
00:07:27,430 --> 00:07:24,960
want to develop

188
00:07:28,550 --> 00:07:27,440

vascularized tissues outside of the body

189
00:07:31,749 --> 00:07:28,560
that also contain

190
00:07:34,870 --> 00:07:31,759
engineered blood vessels

191
00:07:36,629 --> 00:07:34,880
wow okay so it it's it's a crucial

192
00:07:37,670 --> 00:07:36,639
component to basically it's one of the

193
00:07:39,510 --> 00:07:37,680
building blocks

194
00:07:41,110 --> 00:07:39,520
it sounds like to doing more research on

195
00:07:42,870 --> 00:07:41,120
this topic but

196
00:07:44,390 --> 00:07:42,880
why isn't why is it important that we

197
00:07:46,230 --> 00:07:44,400
engineer vascularized tissue

198
00:07:49,830 --> 00:07:46,240
you know what makes it so what makes it

199
00:07:52,469 --> 00:07:49,840
such a difficult challenge to solve

200
00:07:53,270 --> 00:07:52,479
certainly well vascularized tissue

201
00:07:56,309 --> 00:07:53,280
enables

202
00:07:56,869 --> 00:07:56,319
tissue in general to get bigger and

203
00:07:59,110 --> 00:07:56,879
better

204
00:07:59,990 --> 00:07:59,120
blood vessels supply the nutrients and

205
00:08:02,309 --> 00:08:00,000
oxygen that

206
00:08:03,110 --> 00:08:02,319
all tissues in the body need to grow and

207
00:08:05,110 --> 00:08:03,120
function

208
00:08:07,110 --> 00:08:05,120
appropriately and so if we want to

209
00:08:08,309 --> 00:08:07,120
better understand how the human body is

210
00:08:11,830 --> 00:08:08,319
actually functioning

211
00:08:12,550 --> 00:08:11,840
we wanted to engineer true vascularized

212
00:08:17,430 --> 00:08:12,560
tissues

213
00:08:18,309 --> 00:08:17,440

ideally should have the many many blood

214
00:08:20,230 --> 00:08:18,319
vessels

215
00:08:21,749 --> 00:08:20,240
that are found in all tissues in the

216
00:08:24,390 --> 00:08:21,759
human body it's not an

217
00:08:25,189 --> 00:08:24,400
easy thing to do because as a lot of us

218
00:08:28,629 --> 00:08:25,199
know

219
00:08:29,350 --> 00:08:28,639
the human body has hundreds of thousands

220
00:08:32,310 --> 00:08:29,360
of different

221
00:08:34,070 --> 00:08:32,320
capillaries blood vessels arteries veins

222
00:08:35,029 --> 00:08:34,080
all different types of vessels that are

223
00:08:38,149 --> 00:08:35,039
important for

224
00:08:40,070 --> 00:08:38,159
supplying the nutrients to the body and

225
00:08:41,750 --> 00:08:40,080
a lot of times nature is the best

226
00:08:43,190 --> 00:08:41,760
engineer and we're trying to replicate

227
00:08:45,030 --> 00:08:43,200
what nature can do

228
00:08:46,389 --> 00:08:45,040
by introducing as many of these blood

229
00:08:49,990 --> 00:08:46,399
vessels as we can

230
00:08:52,870 --> 00:08:50,000
in these tissues outside the body

231
00:08:56,550 --> 00:08:52,880
wow okay so looking forward how will

232
00:08:57,990 --> 00:08:56,560
this change medicine as we know it

233
00:09:00,550 --> 00:08:58,000
absolutely i think this is going to

234
00:09:03,670 --> 00:09:00,560
change medicine in two ways

235
00:09:06,550 --> 00:09:03,680
one is that these vascularized tissues

236
00:09:07,190 --> 00:09:06,560
will allow us to better understand how

237
00:09:11,190 --> 00:09:07,200
the

238
00:09:13,829 --> 00:09:11,200

human body actually function

239
00:09:15,269 --> 00:09:13,839
as i mentioned all tissues in the body

240
00:09:17,269 --> 00:09:15,279
have blood vessels

241
00:09:18,870 --> 00:09:17,279
so it doesn't matter what disease you're

242
00:09:20,310 --> 00:09:18,880
interested in studying whether it's

243
00:09:23,670 --> 00:09:20,320
cardiovascular disease

244
00:09:24,470 --> 00:09:23,680
liver disease brain disease all diseases

245
00:09:26,630 --> 00:09:24,480
of the body

246
00:09:28,389 --> 00:09:26,640
are intersected with the circulatory

247
00:09:30,870 --> 00:09:28,399
system in the blood vessel network

248
00:09:32,230 --> 00:09:30,880
so if we can engineer better

249
00:09:34,389 --> 00:09:32,240
vascularized tissue

250
00:09:35,269 --> 00:09:34,399
we can study a variety of different

251
00:09:37,590 --> 00:09:35,279
diseases

252
00:09:39,430 --> 00:09:37,600
in a dish so to say and the second

253
00:09:41,670 --> 00:09:39,440
reason why this is really important

254
00:09:43,190 --> 00:09:41,680
is because down the road we want to

255
00:09:44,790 --> 00:09:43,200
potentially use some of this

256
00:09:47,110 --> 00:09:44,800
vascularized tissue

257
00:09:48,470 --> 00:09:47,120
for therapeutic purposes just to give a

258
00:09:51,190 --> 00:09:48,480
simple example

259
00:09:53,350 --> 00:09:51,200
after folks have a heart attack or a

260
00:09:55,750 --> 00:09:53,360
myocardial infarction as we call it

261
00:09:56,470 --> 00:09:55,760
a lot of the cells in your heart are

262
00:09:58,470 --> 00:09:56,480
lost

263
00:09:59,509 --> 00:09:58,480

and ideally you want to be able to

264
00:10:02,550 --> 00:09:59,519
replace those

265
00:10:03,990 --> 00:10:02,560
lost cells with an adequate cell type

266
00:10:06,550 --> 00:10:04,000
that's going to replace the

267
00:10:08,150 --> 00:10:06,560
function of those dead cells and

268
00:10:11,030 --> 00:10:08,160
vascularized tissue

269
00:10:12,790 --> 00:10:11,040
can provide a way to actually restore

270
00:10:14,470 --> 00:10:12,800
the proper function of the heart

271
00:10:15,910 --> 00:10:14,480
so those are just two potential

272
00:10:19,030 --> 00:10:15,920
applications for

273
00:10:22,230 --> 00:10:19,040
this technology so this

274
00:10:24,389 --> 00:10:22,240
all sounds pretty good but

275
00:10:25,990 --> 00:10:24,399
why should the average person care about

276
00:10:28,870 --> 00:10:26,000
this

277
00:10:29,269 --> 00:10:28,880
certainly well vascularized tissue as

278
00:10:31,990 --> 00:10:29,279
i've

279
00:10:32,550 --> 00:10:32,000
alluded to is something that we all have

280
00:10:34,949 --> 00:10:32,560
and

281
00:10:37,269 --> 00:10:34,959
unfortunately we all know folks in our

282
00:10:39,269 --> 00:10:37,279
families who have had to deal with say

283
00:10:40,310 --> 00:10:39,279
cardiovascular disease or neurological

284
00:10:42,790 --> 00:10:40,320
diseases

285
00:10:44,150 --> 00:10:42,800
and if we can better engineer models of

286
00:10:47,030 --> 00:10:44,160
these different diseases

287
00:10:47,670 --> 00:10:47,040
to study these issues potentially in a

288
00:10:49,190 --> 00:10:47,680

dish

289
00:10:51,269 --> 00:10:49,200
then perhaps down the road we can

290
00:10:52,790 --> 00:10:51,279
develop new and improved therapies for

291
00:10:54,630 --> 00:10:52,800
say cardiovascular disease or

292
00:10:55,430 --> 00:10:54,640
neurological disease or even liver

293
00:10:58,150 --> 00:10:55,440
function

294
00:10:59,829 --> 00:10:58,160
so these are translational applications

295
00:11:01,670 --> 00:10:59,839
for vascularized tissue and i think

296
00:11:04,710 --> 00:11:01,680
really the sky's the limit for this

297
00:11:06,550 --> 00:11:04,720
type of technology that's the future i

298
00:11:09,590 --> 00:11:06,560
want to be part of

299
00:11:12,150 --> 00:11:09,600
certainly um i want to know how

300
00:11:13,110 --> 00:11:12,160
you got into this challenge and were you

301
00:11:16,150 --> 00:11:13,120
surprised

302
00:11:18,069 --> 00:11:16,160
to learn that nasa was even doing this

303
00:11:20,230 --> 00:11:18,079
challenge

304
00:11:21,509 --> 00:11:20,240
well i've been excited about the

305
00:11:23,670 --> 00:11:21,519
intersection of

306
00:11:25,910 --> 00:11:23,680
space biology and microgravity research

307
00:11:26,630 --> 00:11:25,920
and cardiovascular research for a long

308
00:11:28,710 --> 00:11:26,640
time

309
00:11:30,470 --> 00:11:28,720
i actually had the opportunity to send

310
00:11:31,910 --> 00:11:30,480
an experiment to the international space

311
00:11:35,269 --> 00:11:31,920
station a few years ago

312
00:11:36,150 --> 00:11:35,279
studying the impact of microgravity on

313
00:11:38,069 --> 00:11:36,160

the human heart

314
00:11:39,269 --> 00:11:38,079
using stem cell-derived heart cells

315
00:11:40,069 --> 00:11:39,279
which are really exciting because you

316
00:11:41,910 --> 00:11:40,079
can see them be

317
00:11:43,350 --> 00:11:41,920
in a dish not something that you see

318
00:11:45,829 --> 00:11:43,360
every single day

319
00:11:46,710 --> 00:11:45,839
and just so happens the astronaut we

320
00:11:49,269 --> 00:11:46,720
were working with

321
00:11:50,949 --> 00:11:49,279
on that project is dr kate rubins who's

322
00:11:52,790 --> 00:11:50,959
not only an outstanding astronaut but

323
00:11:54,150 --> 00:11:52,800
also a cell biologist and i believe

324
00:11:56,230 --> 00:11:54,160
we'll be talking to her

325
00:11:58,790 --> 00:11:56,240
in a few moments so we actually

326
00:12:00,949 --> 00:11:58,800
collaborated in the summer of 2016 to

327
00:12:02,949 --> 00:12:00,959
send these samples to the space station

328
00:12:04,550 --> 00:12:02,959
for a period of about one month during

329
00:12:06,710 --> 00:12:04,560
which time we actually studied

330
00:12:08,150 --> 00:12:06,720
how the human heart and the cells of the

331
00:12:10,949 --> 00:12:08,160
human heart can change

332
00:12:11,350 --> 00:12:10,959
during long-term exposure to low gravity

333
00:12:15,190 --> 00:12:11,360
and

334
00:12:16,710 --> 00:12:15,200
learned a lot from it

335
00:12:18,790 --> 00:12:16,720
but we're always trying to figure out

336
00:12:21,030 --> 00:12:18,800
new ways to improve

337
00:12:21,990 --> 00:12:21,040
these results and improve the subsequent

338
00:12:24,069 --> 00:12:22,000

experiments

339
00:12:25,910 --> 00:12:24,079
and one thing that was really missing in

340
00:12:26,790 --> 00:12:25,920
this experiment that i did you know back

341
00:12:30,069 --> 00:12:26,800
in the day

342
00:12:32,790 --> 00:12:30,079
was a vascularized network of of tissues

343
00:12:34,790 --> 00:12:32,800
a vascular tissue right so this was just

344
00:12:37,430 --> 00:12:34,800
looking at isolated cells in the dish

345
00:12:38,069 --> 00:12:37,440
but as i've mentioned the real human

346
00:12:40,710 --> 00:12:38,079
body

347
00:12:42,949 --> 00:12:40,720
is comprised of many many blood vessels

348
00:12:44,629 --> 00:12:42,959
and so if we want to better understand

349
00:12:47,030 --> 00:12:44,639
how the human body is going to function

350
00:12:49,110 --> 00:12:47,040
in low gravity we have to use these next

351
00:12:51,430 --> 00:12:49,120
generation models that contain these

352
00:12:53,190 --> 00:12:51,440
blood vessels

353
00:12:55,430 --> 00:12:53,200
wow you have given us a lot to think

354
00:12:57,110 --> 00:12:55,440
about and a lot to be excited about

355
00:12:59,110 --> 00:12:57,120
um and i want to thank you for joining

356
00:13:00,949 --> 00:12:59,120
us today thank you so much

357
00:13:02,710 --> 00:13:00,959
thank you again for having me the

358
00:13:05,190 --> 00:13:02,720
benefits of this technology are

359
00:13:06,870 --> 00:13:05,200
so exciting for medicine here on earth

360
00:13:08,870 --> 00:13:06,880
but what about in space

361
00:13:10,790 --> 00:13:08,880
we are now here with robin gayton

362
00:13:11,670 --> 00:13:10,800
director of the international space

363
00:13:13,590 --> 00:13:11,680

station

364
00:13:14,870 --> 00:13:13,600
robin i'm so happy you could join us

365
00:13:17,110 --> 00:13:14,880
today

366
00:13:18,710 --> 00:13:17,120
thank you for having me lauren all right

367
00:13:21,269 --> 00:13:18,720
let's get straight into it

368
00:13:22,790 --> 00:13:21,279
um what technologies or what do

369
00:13:25,350 --> 00:13:22,800
technologies like those being

370
00:13:29,190 --> 00:13:25,360
solved by the vascular tissue challenge

371
00:13:33,030 --> 00:13:30,629
they're important for a couple of

372
00:13:34,470 --> 00:13:33,040
reasons one of the key missions for the

373
00:13:37,430 --> 00:13:34,480
international space station

374
00:13:39,590 --> 00:13:37,440
is to use it as a test bed to enable

375
00:13:40,069 --> 00:13:39,600
future explorations beyond low earth

376
00:13:42,389 --> 00:13:40,079
orbit

377
00:13:44,150 --> 00:13:42,399
so the vascularized thick tissue models

378
00:13:46,069 --> 00:13:44,160
resulting from this challenge

379
00:13:47,829 --> 00:13:46,079
will function as organ analogues or

380
00:13:48,389 --> 00:13:47,839
models that can be used to study deep

381
00:13:51,590 --> 00:13:48,399
space

382
00:13:54,069 --> 00:13:51,600
environmental effects such as radiation

383
00:13:54,949 --> 00:13:54,079
microgravity deconditioning and then

384
00:13:57,430 --> 00:13:54,959
help us develop

385
00:13:59,590 --> 00:13:57,440
strategies to minimize the damage to

386
00:14:01,189 --> 00:13:59,600
healthy cells and mitigate the negative

387
00:14:03,350 --> 00:14:01,199
effects on humans

388
00:14:04,629 --> 00:14:03,360

for these long-duration missions away

389
00:14:06,470 --> 00:14:04,639
from low-earth orbit

390
00:14:07,829 --> 00:14:06,480
one of the other key missions of the

391
00:14:11,670 --> 00:14:07,839
international space station

392
00:14:13,590 --> 00:14:11,680
is to create a new markets in space

393
00:14:15,910 --> 00:14:13,600
we're trying to create an economy

394
00:14:17,189 --> 00:14:15,920
in low-earth orbit where nasa is one of

395
00:14:20,310 --> 00:14:17,199
many customers

396
00:14:23,350 --> 00:14:20,320
and and there's all kinds of other

397
00:14:25,590 --> 00:14:23,360
enterprises going on and so we

398
00:14:26,790 --> 00:14:25,600
think the area of regenerative medicine

399
00:14:29,030 --> 00:14:26,800
and tissue engineering

400
00:14:30,310 --> 00:14:29,040
is one of the most promising of these

401
00:14:33,269 --> 00:14:30,320
potential

402
00:14:35,030 --> 00:14:33,279
applications that can create sustained

403
00:14:38,230 --> 00:14:35,040
non-nasa demand

404
00:14:39,269 --> 00:14:38,240
for ongoing research in microgravity and

405
00:14:41,590 --> 00:14:39,279
in microgravity

406
00:14:44,069 --> 00:14:41,600
it could be possible to print or grow

407
00:14:47,750 --> 00:14:44,079
tissue or even organs better than we can

408
00:14:49,590 --> 00:14:47,760
here on earth that is wild

409
00:14:51,430 --> 00:14:49,600
who would have predicted that i guess

410
00:14:54,310 --> 00:14:51,440
our scientists

411
00:14:56,470 --> 00:14:54,320
um you know so we all love our

412
00:14:58,710 --> 00:14:56,480
astronauts on the iss

413
00:15:00,790 --> 00:14:58,720

but most of us are here on earth so how

414
00:15:04,310 --> 00:15:00,800
can developing technologies for space

415
00:15:06,069 --> 00:15:04,320
affect us here back on planet earth

416
00:15:08,230 --> 00:15:06,079
we have so many technologies we've

417
00:15:09,910 --> 00:15:08,240
developed for space that has spun off to

418
00:15:11,829 --> 00:15:09,920
applications here on earth

419
00:15:13,350 --> 00:15:11,839
and that's that's another key goal of

420
00:15:15,430 --> 00:15:13,360
the international space station

421
00:15:16,949 --> 00:15:15,440
is to do research that benefits life

422
00:15:19,350 --> 00:15:16,959
here on earth

423
00:15:20,389 --> 00:15:19,360
and so on earth the vascularized tissue

424
00:15:22,949 --> 00:15:20,399
could be used in

425
00:15:23,750 --> 00:15:22,959
pharmaceutical testing or disease

426
00:15:25,269 --> 00:15:23,760
modeling

427
00:15:26,949 --> 00:15:25,279
and it could also accelerate new

428
00:15:29,670 --> 00:15:26,959
research and development in the field of

429
00:15:32,069 --> 00:15:29,680
organ transplants as we talked about

430
00:15:33,269 --> 00:15:32,079
other areas that we have developed

431
00:15:35,269 --> 00:15:33,279
technology for

432
00:15:37,350 --> 00:15:35,279
another example is in our water

433
00:15:38,389 --> 00:15:37,360
recycling technology that we use on the

434
00:15:41,590 --> 00:15:38,399
space station

435
00:15:43,430 --> 00:15:41,600
that technology has spun off into

436
00:15:45,350 --> 00:15:43,440
ground-based filtration systems that

437
00:15:47,749 --> 00:15:45,360
have been used in disaster relief

438
00:15:50,470 --> 00:15:47,759

and remote areas where there is no clean

439
00:15:54,710 --> 00:15:52,790
wow this makes me very excited and

440
00:15:56,470 --> 00:15:54,720
hopeful for the future

441
00:15:58,790 --> 00:15:56,480
robin i want to thank you for joining us

442
00:16:00,389 --> 00:15:58,800
today we've really loved having you

443
00:16:02,389 --> 00:16:00,399
thank you i'm excited to have

444
00:16:05,749 --> 00:16:02,399
participated thanks a lot

445
00:16:07,430 --> 00:16:05,759
of course speaking of space exploration

446
00:16:09,350 --> 00:16:07,440
let's hear from someone who knows

447
00:16:11,110 --> 00:16:09,360
firsthand what living and working in

448
00:16:14,069 --> 00:16:11,120
space is all about

449
00:16:15,030 --> 00:16:14,079
coming to us from space astronaut kate

450
00:16:18,389 --> 00:16:15,040
rubins

451
00:16:20,310 --> 00:16:18,399
take it away kate greetings from the

452
00:16:22,949 --> 00:16:20,320
international space station

453
00:16:23,829 --> 00:16:22,959
i'm kate rubins expedition 64 flight

454
00:16:25,389 --> 00:16:23,839
engineer

455
00:16:26,949 --> 00:16:25,399
i'm a nasa astronaut and a

456
00:16:28,710 --> 00:16:26,959
microbiologist

457
00:16:30,470 --> 00:16:28,720
and i want to congratulate the nasa

458
00:16:33,269 --> 00:16:30,480
centennial challenges team

459
00:16:35,189 --> 00:16:33,279
and all of the participating competitors

460
00:16:36,710 --> 00:16:35,199
on the success of the vascular tissue

461
00:16:39,030 --> 00:16:36,720
competition

462
00:16:41,030 --> 00:16:39,040
research conducted here in microgravity

463
00:16:42,550 --> 00:16:41,040

helps nasa prepare for long duration

464
00:16:45,189 --> 00:16:42,560
missions to the moon

465
00:16:46,949 --> 00:16:45,199
to mars and contributes to improvements

466
00:16:48,710 --> 00:16:46,959
for life on earth

467
00:16:51,430 --> 00:16:48,720
during my first space flight mission in

468
00:16:51,990 --> 00:16:51,440
2016 we were able to sequence dna in

469
00:16:54,389 --> 00:16:52,000
space

470
00:16:55,910 --> 00:16:54,399
for the very first time with this

471
00:16:56,870 --> 00:16:55,920
breakthrough in three-dimensional

472
00:16:59,670 --> 00:16:56,880
printing thick

473
00:17:01,269 --> 00:16:59,680
vascularized human organ tissue we could

474
00:17:03,110 --> 00:17:01,279
be able to test the impacts of

475
00:17:04,710 --> 00:17:03,120
microgravity on tissues

476
00:17:07,029 --> 00:17:04,720
right here on the international space

477
00:17:08,230 --> 00:17:07,039
station and this could pave the way for

478
00:17:09,750 --> 00:17:08,240
medical breakthroughs

479
00:17:12,549 --> 00:17:09,760
in tissue and preparation and

480
00:17:14,390 --> 00:17:12,559
regeneration back on earth

481
00:17:16,470 --> 00:17:14,400
i'm excited about the research being

482
00:17:17,029 --> 00:17:16,480
done by all of the vascular tissue

483
00:17:19,750 --> 00:17:17,039
challenge

484
00:17:22,069 --> 00:17:19,760
participants and i really look forward

485
00:17:23,429 --> 00:17:22,079
to potentially working with your tissue

486
00:17:25,510 --> 00:17:23,439
samples here

487
00:17:26,630 --> 00:17:25,520
on the international space station in

488
00:17:32,630 --> 00:17:26,640

the future

489
00:17:34,950 --> 00:17:32,640
thank you and congratulations

490
00:17:36,870 --> 00:17:34,960
thanks kate we are moments away from

491
00:17:39,350 --> 00:17:36,880
announcing the winner of nasa's

492
00:17:40,630 --> 00:17:39,360
vascular tissue challenge but first

493
00:17:41,590 --> 00:17:40,640
let's hear from the methuselah

494
00:17:43,669 --> 00:17:41,600
foundation

495
00:17:46,630 --> 00:17:43,679
an organization that partnered with nasa

496
00:17:48,950 --> 00:17:46,640
to help make this challenge a reality

497
00:17:50,870 --> 00:17:48,960
we are joined by dave gowell thank you

498
00:17:53,909 --> 00:17:50,880
for joining us today dave

499
00:17:55,990 --> 00:17:53,919
it's my pleasure thank you for having me

500
00:17:57,270 --> 00:17:56,000
it's wonderful to have you all right so

501
00:17:59,510 --> 00:17:57,280
let's you know

502
00:18:00,950 --> 00:17:59,520
lay some groundwork here why did you

503
00:18:04,230 --> 00:18:00,960
team up with nasa to

504
00:18:06,630 --> 00:18:04,240
support the vascular tissue challenge

505
00:18:08,630 --> 00:18:06,640
well we're a prize uh funding

506
00:18:11,830 --> 00:18:08,640
organization as well as nasa

507
00:18:14,950 --> 00:18:11,840
about six years ago we had a prize

508
00:18:17,750 --> 00:18:14,960
for the creation of a whole liver

509
00:18:18,230 --> 00:18:17,760
that would be viable in a model organism

510
00:18:19,830 --> 00:18:18,240
for

511
00:18:21,990 --> 00:18:19,840
three months keep it alive keep it

512
00:18:24,789 --> 00:18:22,000
healthy but we were

513
00:18:25,510 --> 00:18:24,799

way too early and the technology didn't

514
00:18:28,630 --> 00:18:25,520
support

515
00:18:30,630 --> 00:18:28,640
that goal and so we

516
00:18:31,669 --> 00:18:30,640
we stepped back and we asked ourselves

517
00:18:34,710 --> 00:18:31,679
what was the real

518
00:18:37,750 --> 00:18:34,720
rate limiter for getting

519
00:18:38,310 --> 00:18:37,760
whole organs and the real problem was

520
00:18:41,350 --> 00:18:38,320
that

521
00:18:44,630 --> 00:18:41,360
you could not scale the tissues up

522
00:18:46,549 --> 00:18:44,640
above 20 cells thick

523
00:18:48,390 --> 00:18:46,559
the tissues would begin to die because

524
00:18:51,549 --> 00:18:48,400
of a lack of blood flow

525
00:18:52,789 --> 00:18:51,559
and that blood flow was provided by

526
00:18:55,750 --> 00:18:52,799
microcirculation

527
00:18:55,990 --> 00:18:55,760
tiny capillaries and vessels and nobody

528
00:18:59,029 --> 00:18:56,000
knew

529
00:19:01,430 --> 00:18:59,039
how to make those and so we thought we

530
00:19:04,430 --> 00:19:01,440
would propose to nasa

531
00:19:06,549 --> 00:19:04,440
the creation of a prize for

532
00:19:09,270 --> 00:19:06,559
microvasculature and

533
00:19:09,990 --> 00:19:09,280
nasa after a couple of years said yes

534
00:19:14,070 --> 00:19:10,000
and so

535
00:19:15,350 --> 00:19:14,080
here we are amazing yeah the rest is

536
00:19:18,870 --> 00:19:15,360
history right

537
00:19:21,510 --> 00:19:18,880
um so where do you see technologies like

538
00:19:22,070 --> 00:19:21,520

growing human tissues and human organs

539
00:19:25,430 --> 00:19:22,080
in

540
00:19:27,750 --> 00:19:25,440
10 20 50 years from now

541
00:19:29,190 --> 00:19:27,760
well in the next five to ten years we

542
00:19:32,390 --> 00:19:29,200
will be able to

543
00:19:35,750 --> 00:19:32,400
make uh tissue patches to

544
00:19:37,029 --> 00:19:35,760
print out uh for instance liver tissue

545
00:19:41,110 --> 00:19:37,039
that would be

546
00:19:43,909 --> 00:19:41,120
added to a sick liver and that liver

547
00:19:44,789 --> 00:19:43,919
could potentially recover itself because

548
00:19:48,870 --> 00:19:44,799
of the

549
00:19:52,390 --> 00:19:48,880
patch

550
00:19:54,310 --> 00:19:52,400
or it would allow for more time uh for a

551
00:19:56,470 --> 00:19:54,320
transplant to become available

552
00:19:58,070 --> 00:19:56,480
so that's actually in a reasonably

553
00:20:01,669 --> 00:19:58,080
near-term future

554
00:20:04,470 --> 00:20:01,679
from a technology standpoint in the next

555
00:20:05,750 --> 00:20:04,480
10 to 15 years i would say that we would

556
00:20:08,950 --> 00:20:05,760
be able to get

557
00:20:12,149 --> 00:20:08,960
whole livers and

558
00:20:14,230 --> 00:20:12,159
whole kidneys and the reason we want to

559
00:20:17,110 --> 00:20:14,240
do that is because there's 110

560
00:20:19,430 --> 00:20:17,120
000 people always on the waiting list

561
00:20:20,950 --> 00:20:19,440
and 25 percent of them pass away while

562
00:20:25,270 --> 00:20:20,960
they're waiting

563
00:20:28,630 --> 00:20:25,280

but there's another 10 times that

564
00:20:31,669 --> 00:20:28,640
that don't qualify to even be on

565
00:20:34,310 --> 00:20:31,679
the list for an organ replacement

566
00:20:35,350 --> 00:20:34,320
so we want to make that all go away and

567
00:20:38,549 --> 00:20:35,360
we want to give the

568
00:20:39,669 --> 00:20:38,559
surgeons all the inventory needed to

569
00:20:43,029 --> 00:20:39,679
make it possible

570
00:20:46,310 --> 00:20:43,039
and then shortly thereafter the

571
00:20:49,430 --> 00:20:46,320
organs will be composed of your own

572
00:20:49,669 --> 00:20:49,440
cells so that you'll never have to be on

573
00:20:52,789 --> 00:20:49,679
an

574
00:20:55,590 --> 00:20:52,799
autoimmune drug it will just be

575
00:20:58,630 --> 00:20:55,600
a new you at least as far as that organ

576
00:21:02,070 --> 00:21:01,190
wow think of the millions of people this

577
00:21:04,549 --> 00:21:02,080
is going to affect

578
00:21:06,310 --> 00:21:04,559
this is incredible i want to thank you

579
00:21:08,789 --> 00:21:06,320
for joining us today we absolutely

580
00:21:10,549 --> 00:21:08,799
loved having you well thank you very

581
00:21:13,750 --> 00:21:10,559
much and thanks to nasa for

582
00:21:14,230 --> 00:21:13,760
sponsoring the prize absolutely as we've

583
00:21:15,830 --> 00:21:14,240
learned

584
00:21:17,669 --> 00:21:15,840
solving the challenge of engineering

585
00:21:20,149 --> 00:21:17,679
vascularized tissue can have

586
00:21:21,350 --> 00:21:20,159
far-reaching benefits for both nasa and

587
00:21:24,149 --> 00:21:21,360
the world

588
00:21:24,870 --> 00:21:24,159

let's explore more the vascular tissue

589
00:21:28,710 --> 00:21:24,880
challenge

590
00:21:31,510 --> 00:21:28,720
is pursuing the idea of creating

591
00:21:32,310 --> 00:21:31,520
a slab of tissue with its own blood

592
00:21:34,310 --> 00:21:32,320
supply

593
00:21:36,149 --> 00:21:34,320
this is going to be like a light switch

594
00:21:38,630 --> 00:21:36,159
at the moment we can make tissues but

595
00:21:39,270 --> 00:21:38,640
we're not good at vascularizing them the

596
00:21:40,950 --> 00:21:39,280
benefits

597
00:21:43,110 --> 00:21:40,960
of creating vascularized tissue are

598
00:21:45,110 --> 00:21:43,120
enormous and they're far-reaching

599
00:21:46,789 --> 00:21:45,120
it would really revolutionize and expand

600
00:21:48,470 --> 00:21:46,799
our ability to treat a multitude of

601
00:21:49,350 --> 00:21:48,480
diseases involving all the different

602
00:21:52,870 --> 00:21:49,360
organ systems

603
00:21:55,110 --> 00:21:52,880
and also for screening toxic effects of

604
00:21:56,549 --> 00:21:55,120
different drugs in the long term there's

605
00:21:58,470 --> 00:21:56,559
even the potential to create whole

606
00:22:00,070 --> 00:21:58,480
organs that could be used to transplant

607
00:22:02,149 --> 00:22:00,080
so why is this technology important to

608
00:22:03,110 --> 00:22:02,159
nasa it would open up the possibilities

609
00:22:05,029 --> 00:22:03,120
of extended space

610
00:22:06,710 --> 00:22:05,039
travel we could use them to look at the

611
00:22:08,630 --> 00:22:06,720
effect of things like gravity that could

612
00:22:10,470 --> 00:22:08,640
enable us to advance the space program

613
00:22:12,390 --> 00:22:10,480

without sending someone into deep space

614
00:22:13,990 --> 00:22:12,400
or having to recreate that environment

615
00:22:15,510 --> 00:22:14,000
in total and at the end of the day

616
00:22:16,870 --> 00:22:15,520
improve lives forever

617
00:22:19,029 --> 00:22:16,880
that's why we need something like the

618
00:22:20,710 --> 00:22:19,039
nasa centaurion challenge it can really

619
00:22:23,830 --> 00:22:20,720
change the face of medicine

620
00:22:26,070 --> 00:22:23,840
as we know it and now for the exciting

621
00:22:28,149 --> 00:22:26,080
moment we've all been waiting for here

622
00:22:29,270 --> 00:22:28,159
is nasa's associate administrator for

623
00:22:31,590 --> 00:22:29,280
space technology

624
00:22:35,430 --> 00:22:31,600
jim reuter to reveal the winner of

625
00:22:37,350 --> 00:22:35,440
nasa's vascular tissue challenge

626
00:22:38,710 --> 00:22:37,360
on behalf of nasa's space technology

627
00:22:40,789 --> 00:22:38,720
mission directorate

628
00:22:43,430 --> 00:22:40,799
the prizes challenges and crowdsourcing

629
00:22:45,029 --> 00:22:43,440
program and the entire agency

630
00:22:47,190 --> 00:22:45,039
i'd like to congratulate all of the

631
00:22:48,630 --> 00:22:47,200
participants of the vascular tissue

632
00:22:50,390 --> 00:22:48,640
challenge

633
00:22:52,149 --> 00:22:50,400
you know when we set out to open this

634
00:22:54,789 --> 00:22:52,159
challenge in 2016

635
00:22:56,070 --> 00:22:54,799
we couldn't imagine the success we'd see

636
00:22:58,549 --> 00:22:56,080
from these teams

637
00:22:59,510 --> 00:22:58,559
in fact i recall us talking about that

638
00:23:01,350 --> 00:22:59,520

this challenge

639
00:23:03,909 --> 00:23:01,360
to produce thick metabolically

640
00:23:05,270 --> 00:23:03,919
functional human vascularized tissue was

641
00:23:06,830 --> 00:23:05,280
maybe a step too far

642
00:23:09,110 --> 00:23:06,840
it could not be done in the time

643
00:23:10,549 --> 00:23:09,120
allotted but these teams have worked

644
00:23:13,110 --> 00:23:10,559
through many setbacks

645
00:23:15,029 --> 00:23:13,120
associated with a global pandemic often

646
00:23:16,230 --> 00:23:15,039
with limited or no access to the to

647
00:23:17,909 --> 00:23:16,240
their labs

648
00:23:20,230 --> 00:23:17,919
their dedication to the medical and

649
00:23:22,230 --> 00:23:20,240
space communities is an example

650
00:23:23,350 --> 00:23:22,240
of how even through adversity the

651
00:23:25,909 --> 00:23:23,360
american people

652
00:23:26,950 --> 00:23:25,919
will persevere with the ability to

653
00:23:28,870 --> 00:23:26,960
regenerate thick

654
00:23:30,630 --> 00:23:28,880
vascularized tissue we can make an

655
00:23:33,750 --> 00:23:30,640
enormous impact on earth

656
00:23:35,190 --> 00:23:33,760
and in space and so it is my pleasure

657
00:23:37,590 --> 00:23:35,200
to announce the first place winner of

658
00:23:39,270 --> 00:23:37,600
the competition team winston

659
00:23:41,430 --> 00:23:39,280
from wake forest institute for

660
00:23:43,990 --> 00:23:41,440
regenerative medicine

661
00:23:46,070 --> 00:23:44,000
team winston will receive 300 000 from

662
00:23:48,310 --> 00:23:46,080
nasa for their innovation

663
00:23:50,549 --> 00:23:48,320

additionally thanks to the iss national

664
00:23:52,230 --> 00:23:50,559
lab managed by cases

665
00:23:53,590 --> 00:23:52,240
team winston will have the opportunity

666
00:23:55,430 --> 00:23:53,600
to test their tissue

667
00:23:58,549 --> 00:23:55,440
under the effects of microgravity

668
00:24:00,470 --> 00:23:58,559
onboard the international space station

669
00:24:02,549 --> 00:24:00,480
selections for competitions like these

670
00:24:04,310 --> 00:24:02,559
couldn't happen without our judges who

671
00:24:06,470 --> 00:24:04,320
are truly experts in their field

672
00:24:08,070 --> 00:24:06,480
from across the country i'd like to

673
00:24:09,110 --> 00:24:08,080
thank each one of you for lending your

674
00:24:11,510 --> 00:24:09,120
expertise

675
00:24:13,269 --> 00:24:11,520
and for ensuring our participating teams

676
00:24:15,750 --> 00:24:13,279
successfully created tissues

677
00:24:17,430 --> 00:24:15,760
that we can use to study deep space

678
00:24:19,909 --> 00:24:17,440
environmental effects

679
00:24:21,029 --> 00:24:19,919
so again congratulations to team winston

680
00:24:22,710 --> 00:24:21,039
on your achievement

681
00:24:25,110 --> 00:24:22,720
and thank you to everyone involved in

682
00:24:30,230 --> 00:24:25,120
the competition for your contributions

683
00:24:33,430 --> 00:24:33,110
and we are here live with kelsey wilson

684
00:24:36,470 --> 00:24:33,440
from

685
00:24:37,190 --> 00:24:36,480
team winston the first place winners of

686
00:24:38,710 --> 00:24:37,200
nasa's

687
00:24:42,630 --> 00:24:38,720
vascular tissue challenge

688
00:24:44,470 --> 00:24:42,640

congratulations kelsey and team

689
00:24:46,710 --> 00:24:44,480
thank you so much for being or for

690
00:24:48,710 --> 00:24:46,720
having me on here

691
00:24:50,870 --> 00:24:48,720
it's really exciting to have you after

692
00:24:51,190 --> 00:24:50,880
all of you know all this challenge had

693
00:24:57,350 --> 00:24:51,200
to

694
00:24:57,990 --> 00:24:57,360
is vascular tissue challenge judge dr

695
00:24:59,990 --> 00:24:58,000
arun

696
00:25:01,669 --> 00:25:00,000
sharma welcome back to the show dr

697
00:25:05,029 --> 00:25:01,679
sharma

698
00:25:07,590 --> 00:25:05,039
thank you for having me okay so we've

699
00:25:11,029 --> 00:25:07,600
got lots of questions for our two guests

700
00:25:13,190 --> 00:25:11,039
um the first one is uh you're the first

701
00:25:14,230 --> 00:25:13,200
person to accomplish this task kelsey

702
00:25:15,669 --> 00:25:14,240
you and your team

703
00:25:18,710 --> 00:25:15,679
how does that feel how are you and your

704
00:25:22,230 --> 00:25:20,710
well for me personally it feels a little

705
00:25:24,149 --> 00:25:22,240
surreal

706
00:25:25,990 --> 00:25:24,159
we work on these projects for years and

707
00:25:26,710 --> 00:25:26,000
you spend hours and hours in lab but it

708
00:25:29,029 --> 00:25:26,720
is

709
00:25:30,310 --> 00:25:29,039
absolutely amazing to get something all

710
00:25:32,549 --> 00:25:30,320
the way to the point that we can

711
00:25:33,350 --> 00:25:32,559
really bring it to the public um so

712
00:25:36,070 --> 00:25:33,360
that's been

713
00:25:37,590 --> 00:25:36,080

very exciting and to be honest when i

714
00:25:39,510 --> 00:25:37,600
started grad school

715
00:25:40,630 --> 00:25:39,520
four years ago i certainly never

716
00:25:43,029 --> 00:25:40,640
imagined that i would be

717
00:25:46,470 --> 00:25:43,039
being interviewed by nasa so yeah i

718
00:25:49,990 --> 00:25:49,269
absolutely um dr sharma i understand

719
00:25:53,269 --> 00:25:50,000
this is a

720
00:25:54,950 --> 00:25:53,279
pretty remarkable accomplishment um

721
00:25:57,029 --> 00:25:54,960
having judged this competition how much

722
00:25:58,390 --> 00:25:57,039
of an achievement is it to finally have

723
00:25:59,430 --> 00:25:58,400
solved this incredible feat of

724
00:26:02,870 --> 00:25:59,440
engineering

725
00:26:04,630 --> 00:26:02,880
uh functional human tissue

726
00:26:06,710 --> 00:26:04,640
it's a tremendous tremendous

727
00:26:09,830 --> 00:26:06,720
accomplishment it's um

728
00:26:10,230 --> 00:26:09,840
not easy to create a portion of tissue

729
00:26:12,630 --> 00:26:10,240
that

730
00:26:14,230 --> 00:26:12,640
contains blood vessels is able to

731
00:26:16,630 --> 00:26:14,240
survive for a month

732
00:26:18,789 --> 00:26:16,640
and is still able to be functional just

733
00:26:20,549 --> 00:26:18,799
meeting one of those criteria would be

734
00:26:22,310 --> 00:26:20,559
an accomplishment but the fact that

735
00:26:25,110 --> 00:26:22,320
kelsey and her team were able to

736
00:26:27,830 --> 00:26:25,120
meet all three criteria is is absolutely

737
00:26:31,750 --> 00:26:30,070
kelsey tell us about the winning tissue

738
00:26:33,830 --> 00:26:31,760

sample and the approach that you

739
00:26:35,830 --> 00:26:33,840
and your team took to solving this

740
00:26:37,990 --> 00:26:35,840
problem

741
00:26:39,909 --> 00:26:38,000
of course well we started out with some

742
00:26:41,830 --> 00:26:39,919
of the criteria that was laid out by

743
00:26:43,830 --> 00:26:41,840
nasa and the methuselah foundation

744
00:26:45,430 --> 00:26:43,840
um really starting with it needed to be

745
00:26:46,870 --> 00:26:45,440
a centimeter in each direction to make

746
00:26:48,149 --> 00:26:46,880
it really large and something that we

747
00:26:50,710 --> 00:26:48,159
could potentially use

748
00:26:52,710 --> 00:26:50,720
you know for studying whole organs and

749
00:26:54,070 --> 00:26:52,720
then we took a pretty stepwise approach

750
00:26:56,230 --> 00:26:54,080
we looked at

751
00:26:57,590 --> 00:26:56,240
what shape would be the best for getting

752
00:26:59,430 --> 00:26:57,600
fluid flow

753
00:27:00,789 --> 00:26:59,440
all the way through the samples and for

754
00:27:02,470 --> 00:27:00,799
getting nutrients in and out of it and

755
00:27:04,149 --> 00:27:02,480
settled on a gyroid shape

756
00:27:05,750 --> 00:27:04,159
which is a series of interconnecting

757
00:27:07,669 --> 00:27:05,760
wave-like tubes

758
00:27:09,350 --> 00:27:07,679
and then we looked at the best gel for

759
00:27:11,110 --> 00:27:09,360
allowing ourselves to really grow and

760
00:27:13,110 --> 00:27:11,120
expand and communicate with each other

761
00:27:14,630 --> 00:27:13,120
which ended up being a modified gelatin

762
00:27:17,029 --> 00:27:14,640
sort of similar to what you might make

763
00:27:19,510 --> 00:27:17,039

jello out of at home in your kitchen

764
00:27:21,350 --> 00:27:19,520
and then building a circulation system

765
00:27:22,870 --> 00:27:21,360
that we could get fluid flow through and

766
00:27:24,630 --> 00:27:22,880
you know really allow these samples to

767
00:27:27,350 --> 00:27:24,640
be perfused in a way similar to what you

768
00:27:29,510 --> 00:27:27,360
see in the human body

769
00:27:33,110 --> 00:27:29,520
that is a use of jello that i never

770
00:27:34,630 --> 00:27:33,120
thought would be applied in this context

771
00:27:36,789 --> 00:27:34,640
dr sharma you've been a judge for this

772
00:27:39,190 --> 00:27:36,799
challenge for nearly five years now

773
00:27:40,630 --> 00:27:39,200
uh in addition to the work that you do

774
00:27:41,590 --> 00:27:40,640
what do you get out of judging this

775
00:27:45,350 --> 00:27:41,600
competition both

776
00:27:48,230 --> 00:27:45,360
professionally but also personally

777
00:27:49,909 --> 00:27:48,240
right so personally it's very gratifying

778
00:27:52,389 --> 00:27:49,919
to see the incredibly

779
00:27:53,990 --> 00:27:52,399
talented young minds around the country

780
00:27:57,110 --> 00:27:54,000
coming together to address

781
00:27:58,870 --> 00:27:57,120
this very unique problem so it's it's

782
00:28:01,110 --> 00:27:58,880
tremendous from the perspective of the

783
00:28:02,549 --> 00:28:01,120
judge to see all of the unique solutions

784
00:28:04,149 --> 00:28:02,559
that the different teams

785
00:28:06,389 --> 00:28:04,159
have come up with to actually address

786
00:28:08,070 --> 00:28:06,399
some of these concerns when it comes to

787
00:28:09,269 --> 00:28:08,080
tissue functionality and tissue

788
00:28:11,350 --> 00:28:09,279

vascularization

789
00:28:13,190 --> 00:28:11,360
but if we're talking about the long-term

790
00:28:13,669 --> 00:28:13,200
medical applications something like this

791
00:28:17,590 --> 00:28:13,679
is

792
00:28:19,510 --> 00:28:17,600
perhaps some of these vascularized

793
00:28:21,669 --> 00:28:19,520
tissues may be able to serve

794
00:28:22,789 --> 00:28:21,679
as replacement tissues for tissues that

795
00:28:25,269 --> 00:28:22,799
are lost due to

796
00:28:27,190 --> 00:28:25,279
injury or disease so this is a

797
00:28:28,950 --> 00:28:27,200
critically important challenge and again

798
00:28:29,430 --> 00:28:28,960
i wanted to congratulate kelsey and her

799
00:28:33,830 --> 00:28:29,440
team

800
00:28:36,230 --> 00:28:33,840
tremendous work

801
00:28:37,350 --> 00:28:36,240
indeed um kelsey what was it like to

802
00:28:39,909 --> 00:28:37,360
work with nasa

803
00:28:42,470 --> 00:28:39,919
and would you recommend that experience

804
00:28:44,870 --> 00:28:42,480
to others

805
00:28:45,510 --> 00:28:44,880
absolutely i think nasa was incredible

806
00:28:48,470 --> 00:28:45,520
through this

807
00:28:50,230 --> 00:28:48,480
um not only was this a scientifically

808
00:28:52,789 --> 00:28:50,240
difficult challenge to work around

809
00:28:53,909 --> 00:28:52,799
but also i mean with covet in particular

810
00:28:54,789 --> 00:28:53,919
we had quite a few technical

811
00:28:56,710 --> 00:28:54,799
difficulties

812
00:28:58,310 --> 00:28:56,720
uh the judging committee for example

813
00:29:00,149 --> 00:28:58,320

couldn't come out and follow us around

814
00:29:02,230 --> 00:29:00,159
labs so we had to do that all

815
00:29:03,590 --> 00:29:02,240
over zoom and they were absolutely

816
00:29:05,110 --> 00:29:03,600
wonderful

817
00:29:06,549 --> 00:29:05,120
helping us both along with the

818
00:29:08,470 --> 00:29:06,559
scientific challenges that we came up

819
00:29:10,830 --> 00:29:08,480
against but then also

820
00:29:14,310 --> 00:29:10,840
certain technical hurdles that we had to

821
00:29:18,310 --> 00:29:16,549
uh yeah a covet alone would have been a

822
00:29:19,750 --> 00:29:18,320
serious hurdle but everything else you

823
00:29:21,029 --> 00:29:19,760
know on top of that makes it an

824
00:29:22,870 --> 00:29:21,039
incredible feat

825
00:29:25,110 --> 00:29:22,880
what's next for your team you know do

826
00:29:26,549 --> 00:29:25,120
you get a break now is this sort of

827
00:29:28,710 --> 00:29:26,559
you know the only thing you were working

828
00:29:30,870 --> 00:29:28,720
on what's up with your with your lab

829
00:29:32,230 --> 00:29:30,880
after this

830
00:29:34,389 --> 00:29:32,240
well for those of you who aren't in

831
00:29:35,830 --> 00:29:34,399
research it's pretty rare for any one of

832
00:29:37,510 --> 00:29:35,840
us not to have a couple different

833
00:29:40,470 --> 00:29:37,520
projects going so

834
00:29:41,510 --> 00:29:40,480
i know that the team a is continuing

835
00:29:43,190 --> 00:29:41,520
this work and

836
00:29:44,950 --> 00:29:43,200
you know gets to send it up into space

837
00:29:47,269 --> 00:29:44,960
which is very exciting

838
00:29:48,389 --> 00:29:47,279

um but one of the other major members of

839
00:29:50,310 --> 00:29:48,399
this dr moon

840
00:29:52,389 --> 00:29:50,320
is working on taking this gyroid and

841
00:29:54,389 --> 00:29:52,399
applying it to neural tissue to look at

842
00:29:55,990 --> 00:29:54,399
possibly developing a blood brain

843
00:29:58,149 --> 00:29:56,000
barrier prototype

844
00:29:59,830 --> 00:29:58,159
and i myself am going to be able to

845
00:30:01,750 --> 00:29:59,840
spend a little bit more time focusing on

846
00:30:02,230 --> 00:30:01,760
some of my work developing 3d printed

847
00:30:05,190 --> 00:30:02,240
skin

848
00:30:08,149 --> 00:30:05,200
and adding hair follicles into it so a

849
00:30:11,350 --> 00:30:08,159
lot of different projects

850
00:30:12,549 --> 00:30:11,360
it sounds like it that is incredible um

851
00:30:14,710 --> 00:30:12,559
this question i think would be

852
00:30:17,510 --> 00:30:14,720
interesting coming from both of you

853
00:30:18,470 --> 00:30:17,520
not every uh team took the same approach

854
00:30:20,549 --> 00:30:18,480
obviously

855
00:30:21,750 --> 00:30:20,559
um there were many ways to solve this

856
00:30:23,830 --> 00:30:21,760
challenge uh

857
00:30:24,789 --> 00:30:23,840
i mean could you talk a little bit about

858
00:30:27,830 --> 00:30:24,799
that what you did

859
00:30:30,149 --> 00:30:27,840
kelsey i mean because you were on the

860
00:30:31,350 --> 00:30:30,159
winning team and the second place team

861
00:30:33,269 --> 00:30:31,360
and our judge here

862
00:30:36,070 --> 00:30:33,279
probably saw many approaches as well so

863
00:30:36,789 --> 00:30:36,080

kelsey if you could take that first well

864
00:30:39,350 --> 00:30:36,799
of course

865
00:30:41,269 --> 00:30:39,360
um as you just said we actually had two

866
00:30:43,830 --> 00:30:41,279
different teams working on this at wake

867
00:30:44,870 --> 00:30:43,840
and we both took very different

868
00:30:46,310 --> 00:30:44,880
approaches to it

869
00:30:48,310 --> 00:30:46,320
even though we were using bio printing

870
00:30:49,750 --> 00:30:48,320
we used we used two different types of

871
00:30:51,430 --> 00:30:49,760
bio printing

872
00:30:53,110 --> 00:30:51,440
came up with structures that looked very

873
00:30:55,510 --> 00:30:53,120
different despite the fact that they

874
00:30:57,110 --> 00:30:55,520
both met the challenge requirements so

875
00:30:59,430 --> 00:30:57,120
you know even within the institute we

876
00:31:01,669 --> 00:30:59,440
had multiple ways of attempting

877
00:31:03,029 --> 00:31:01,679
this and i can't wait to see what the

878
00:31:06,230 --> 00:31:03,039
other groups came up with because

879
00:31:07,750 --> 00:31:06,240
i assume that they are outside of my

880
00:31:11,029 --> 00:31:07,760
imagination and

881
00:31:12,950 --> 00:31:11,039
probably just wonderful

882
00:31:15,430 --> 00:31:12,960
absolutely you're totally right kelsey

883
00:31:18,230 --> 00:31:15,440
and as a judge i've had an inside look

884
00:31:20,070 --> 00:31:18,240
into what teams around the country have

885
00:31:20,710 --> 00:31:20,080
been able to do and it's astounding

886
00:31:22,310 --> 00:31:20,720
really

887
00:31:24,630 --> 00:31:22,320
all these exceptionally talented

888
00:31:26,230 --> 00:31:24,640

bioengineers have utilized a number of

889
00:31:27,590 --> 00:31:26,240
different approaches including 3d

890
00:31:30,070 --> 00:31:27,600
printing for example

891
00:31:32,310 --> 00:31:30,080
to create custom tissues that have a

892
00:31:32,870 --> 00:31:32,320
variety of different cell types we had

893
00:31:35,830 --> 00:31:32,880
teams

894
00:31:36,870 --> 00:31:35,840
utilizing liver tissue heart tissue and

895
00:31:39,190 --> 00:31:36,880
so on

896
00:31:41,590 --> 00:31:39,200
and it the end the possibilities are

897
00:31:43,110 --> 00:31:41,600
really endless as to how the cell types

898
00:31:45,669 --> 00:31:43,120
can be properly as

899
00:31:49,430 --> 00:31:45,679
integrated and intersected with the

900
00:31:52,710 --> 00:31:51,269
and actually i'd like to piggyback off

901
00:31:55,830 --> 00:31:52,720
of that what did

902
00:31:57,750 --> 00:31:55,840
it take for the uh for a team to win

903
00:31:59,110 --> 00:31:57,760
this challenge dr charlemage what

904
00:32:05,669 --> 00:31:59,120
basically

905
00:32:07,669 --> 00:32:05,679
about kelsey's team

906
00:32:09,509 --> 00:32:07,679
right so kelsey's team was the first

907
00:32:11,830 --> 00:32:09,519
team to successfully meet

908
00:32:13,669 --> 00:32:11,840
multiple criteria that are associated

909
00:32:15,909 --> 00:32:13,679
with the success of this challenge

910
00:32:17,430 --> 00:32:15,919
as i alluded to this was a very

911
00:32:18,549 --> 00:32:17,440
difficult challenge in the first place

912
00:32:20,549 --> 00:32:18,559
but the fact that you had to meet

913
00:32:21,509 --> 00:32:20,559

multiple criteria made it even more

914
00:32:23,990 --> 00:32:21,519
challenging

915
00:32:25,990 --> 00:32:24,000
so one criteria was functionality the

916
00:32:27,909 --> 00:32:26,000
tissues that were actually developed

917
00:32:29,029 --> 00:32:27,919
have to be functional for an extended

918
00:32:31,190 --> 00:32:29,039
period of time in

919
00:32:33,350 --> 00:32:31,200
one month in particular also these

920
00:32:34,950 --> 00:32:33,360
tissues have to be vascularized so they

921
00:32:37,590 --> 00:32:34,960
have to contain the cells

922
00:32:39,269 --> 00:32:37,600
that line the blood vessels in the body

923
00:32:40,830 --> 00:32:39,279
and they have to survive they have to

924
00:32:43,430 --> 00:32:40,840
appropriately survive

925
00:32:43,830 --> 00:32:43,440
long-term again our timeline was at

926
00:32:46,149 --> 00:32:43,840
least

927
00:32:48,070 --> 00:32:46,159
one month and kelsey's team was the

928
00:32:50,230 --> 00:32:48,080
first to accomplish

929
00:32:51,430 --> 00:32:50,240
these these tasks and to meet these

930
00:32:53,750 --> 00:32:51,440
criteria so

931
00:32:58,070 --> 00:32:53,760
an exceptionally challenging task but

932
00:33:01,590 --> 00:33:00,149
yeah i'm curious this is we've been

933
00:33:03,990 --> 00:33:01,600
talking about how challenging

934
00:33:05,509 --> 00:33:04,000
something like this is what that and

935
00:33:06,389 --> 00:33:05,519
this is a question i'd like to ask of

936
00:33:08,630 --> 00:33:06,399
you both

937
00:33:10,630 --> 00:33:08,640
what motivates you to do this kind of

938
00:33:11,269 --> 00:33:10,640

work you know kelsey you and your team

939
00:33:13,909 --> 00:33:11,279
and then dr

940
00:33:15,669 --> 00:33:13,919
sharma you judging but also the work you

941
00:33:17,269 --> 00:33:15,679
do outside of judging what what

942
00:33:21,509 --> 00:33:17,279
motivates you to do this

943
00:33:26,230 --> 00:33:24,149
well i think that there's you know a lot

944
00:33:28,789 --> 00:33:26,240
of different motivating factors

945
00:33:30,070 --> 00:33:28,799
i know for me personally some of this is

946
00:33:32,789 --> 00:33:30,080
getting to be able

947
00:33:33,509 --> 00:33:32,799
to have something that will really help

948
00:33:35,669 --> 00:33:33,519
the

949
00:33:36,549 --> 00:33:35,679
research community you know be able to

950
00:33:38,710 --> 00:33:36,559
study

951
00:33:40,470 --> 00:33:38,720
diseases and different disease states

952
00:33:41,509 --> 00:33:40,480
and even healthy systems and maybe be

953
00:33:42,870 --> 00:33:41,519
able to come up with something that we

954
00:33:45,029 --> 00:33:42,880
can use to

955
00:33:46,230 --> 00:33:45,039
test different medicines on rather than

956
00:33:49,509 --> 00:33:46,240
having to go

957
00:33:52,389 --> 00:33:49,519
to animal or straight to human testing

958
00:33:53,110 --> 00:33:52,399
but also it gives a really unique

959
00:33:55,750 --> 00:33:53,120
perspective

960
00:33:58,230 --> 00:33:55,760
into a building block that as has been

961
00:33:59,990 --> 00:33:58,240
talked about earlier in this segment

962
00:34:02,470 --> 00:34:00,000
i'm really hopeful can eventually come

963
00:34:03,190 --> 00:34:02,480

up with whole organs that can be used

964
00:34:05,350 --> 00:34:03,200
for

965
00:34:08,389 --> 00:34:05,360
you know organ replacement in the future

966
00:34:12,710 --> 00:34:10,710
yeah i agree with the kelsey absolutely

967
00:34:15,430 --> 00:34:12,720
building blocks for the next step

968
00:34:16,950 --> 00:34:15,440
um i think the hope ultimately the hope

969
00:34:18,310 --> 00:34:16,960
in this field in regenerative medicine

970
00:34:20,629 --> 00:34:18,320
and bioengineering

971
00:34:22,069 --> 00:34:20,639
is to design pieces of tissues that may

972
00:34:24,389 --> 00:34:22,079
be able to one day

973
00:34:26,629 --> 00:34:24,399
replace tissues that are damaged or

974
00:34:28,310 --> 00:34:26,639
injured i think it's a dream and it's a

975
00:34:30,869 --> 00:34:28,320
it's something that can

976
00:34:34,149 --> 00:34:30,879
positively benefit the lives of millions

977
00:34:36,950 --> 00:34:34,159
of people around the world

978
00:34:38,710 --> 00:34:36,960
that's incredibly exciting um and what

979
00:34:39,270 --> 00:34:38,720
else is really exciting is that i

980
00:34:42,230 --> 00:34:39,280
understand

981
00:34:43,829 --> 00:34:42,240
kelsey your sample will fly to the iss

982
00:34:46,310 --> 00:34:43,839
for further testing

983
00:34:47,430 --> 00:34:46,320
so what are you hoping to gain from from

984
00:34:51,430 --> 00:34:47,440
testing

985
00:34:55,270 --> 00:34:52,869
well i think the first thing we're

986
00:34:57,670 --> 00:34:55,280
really hoping to look at is

987
00:34:59,670 --> 00:34:57,680
how space affects this i mean we know

988
00:35:01,829 --> 00:34:59,680

that humans react differently

989
00:35:04,470 --> 00:35:01,839
in space conditions than they do here on

990
00:35:08,069 --> 00:35:04,480
earth and there's been a lot of tests

991
00:35:10,790 --> 00:35:08,079
as dr sharma has talked about looking at

992
00:35:11,270 --> 00:35:10,800
cells being grown in microgravity and

993
00:35:13,349 --> 00:35:11,280
under

994
00:35:14,829 --> 00:35:13,359
you know other space conditions

995
00:35:17,990 --> 00:35:14,839
including

996
00:35:20,230 --> 00:35:18,000
radioactivity but those

997
00:35:22,630 --> 00:35:20,240
have confounding factors they aren't fed

998
00:35:23,750 --> 00:35:22,640
via flow they're in a static media

999
00:35:26,310 --> 00:35:23,760
culture and

1000
00:35:27,349 --> 00:35:26,320
that microgravity system has been shown

1001
00:35:29,190 --> 00:35:27,359
to change

1002
00:35:30,870 --> 00:35:29,200
how much oxygen they're able to get into

1003
00:35:32,630 --> 00:35:30,880
that culture and it will be

1004
00:35:34,470 --> 00:35:32,640
you know personally very interesting to

1005
00:35:37,589 --> 00:35:34,480
look at

1006
00:35:40,390 --> 00:35:37,599
how the space

1007
00:35:41,589 --> 00:35:40,400
environment actually ends up affecting a

1008
00:35:45,190 --> 00:35:41,599
system that's fed

1009
00:35:47,510 --> 00:35:45,200
in a physiological manner

1010
00:35:49,670 --> 00:35:47,520
and dr sharma as someone who has done

1011
00:35:51,109 --> 00:35:49,680
research in this in the past on this i

1012
00:35:52,710 --> 00:35:51,119
would love to get your take on that as

1013
00:35:54,950 --> 00:35:52,720

well

1014
00:35:57,109 --> 00:35:54,960
certainly um so as i alluded to

1015
00:35:59,349 --> 00:35:57,119
previously the work that i've done is in

1016
00:36:00,550 --> 00:35:59,359
dimensional cell cultures so cells grown

1017
00:36:03,190 --> 00:36:00,560
in in 2d

1018
00:36:04,710 --> 00:36:03,200
and really the human body functions in

1019
00:36:06,310 --> 00:36:04,720
three dimensions right so that's part of

1020
00:36:08,630 --> 00:36:06,320
the reason why this challenge is

1021
00:36:10,710 --> 00:36:08,640
so exciting we want to be able to create

1022
00:36:11,910 --> 00:36:10,720
better models of how the human body is

1023
00:36:12,550 --> 00:36:11,920
actually going to function in low

1024
00:36:15,109 --> 00:36:12,560
gravity

1025
00:36:16,870 --> 00:36:15,119
during extended space flight so a

1026
00:36:17,510 --> 00:36:16,880
three-dimensional tissue will be able to

1027
00:36:20,230 --> 00:36:17,520
better

1028
00:36:21,349 --> 00:36:20,240
tell us about exactly that the impacts

1029
00:36:24,230 --> 00:36:21,359
of low gravity

1030
00:36:25,430 --> 00:36:24,240
on the human body in addition the

1031
00:36:27,910 --> 00:36:25,440
international space station

1032
00:36:28,950 --> 00:36:27,920
as a research laboratory is largely for

1033
00:36:31,510 --> 00:36:28,960
the benefit for

1034
00:36:32,470 --> 00:36:31,520
those of us here on the earth so we want

1035
00:36:34,790 --> 00:36:32,480
to

1036
00:36:36,310 --> 00:36:34,800
model some of these phenomena such as

1037
00:36:39,430 --> 00:36:36,320
accelerated aging

1038
00:36:42,550 --> 00:36:39,440

because in in a lot of senses in

1039
00:36:43,670 --> 00:36:42,560
in a significant way the phenomena that

1040
00:36:46,150 --> 00:36:43,680
you see

1041
00:36:48,230 --> 00:36:46,160
in low gravity during space flight is a

1042
00:36:49,109 --> 00:36:48,240
form of accelerated aging the bones of

1043
00:36:51,430 --> 00:36:49,119
the body

1044
00:36:53,030 --> 00:36:51,440
are deteriorating at a slightly faster

1045
00:36:55,190 --> 00:36:53,040
rate the muscles as well

1046
00:36:57,270 --> 00:36:55,200
and so what we learned from these

1047
00:36:59,349 --> 00:36:57,280
studies of in vitro models and

1048
00:37:02,150 --> 00:36:59,359
three-dimensional 3d printed models

1049
00:37:03,510 --> 00:37:02,160
will help us better understand aging

1050
00:37:06,069 --> 00:37:03,520
something that we're all going through

1051
00:37:09,829 --> 00:37:06,079
here on earth

1052
00:37:11,270 --> 00:37:09,839
yes 100 percent um i'm not the only one

1053
00:37:13,270 --> 00:37:11,280
asking questions here

1054
00:37:14,630 --> 00:37:13,280
uh all of you have been asking questions

1055
00:37:16,710 --> 00:37:14,640
online since the beginning of this

1056
00:37:18,550 --> 00:37:16,720
episode so let's get to those

1057
00:37:20,230 --> 00:37:18,560
um don't forget you can ask your

1058
00:37:23,109 --> 00:37:20,240
questions by using the hashtag

1059
00:37:24,150 --> 00:37:23,119
ask nasa or by writing in the comment

1060
00:37:27,190 --> 00:37:24,160
box wherever

1061
00:37:30,310 --> 00:37:27,200
you are watching this okay so our first

1062
00:37:31,030 --> 00:37:30,320
question is from spacegirl123 that's

1063
00:37:34,230 --> 00:37:31,040

cute

1064
00:37:37,030 --> 00:37:34,240
on twitter and she asks why is nasa

1065
00:37:38,310 --> 00:37:37,040
interested in engineering human tissue

1066
00:37:40,870 --> 00:37:38,320
everyone why don't we throw that one to

1067
00:37:44,630 --> 00:37:43,349
surely absolutely um and just like i

1068
00:37:46,069 --> 00:37:44,640
alluded to

1069
00:37:48,310 --> 00:37:46,079
nasa is really interested in this

1070
00:37:51,990 --> 00:37:48,320
because we want to understand

1071
00:37:55,270 --> 00:37:52,000
ways that this tissue can perhaps

1072
00:37:58,710 --> 00:37:55,280
improve the functionality of tissues

1073
00:37:59,510 --> 00:37:58,720
on the planet so we perhaps this tissue

1074
00:38:01,910 --> 00:37:59,520
will be

1075
00:38:03,670 --> 00:38:01,920
better more functional in a microgravity

1076
00:38:04,069 --> 00:38:03,680
environment that'll tell us more about

1077
00:38:06,069 --> 00:38:04,079
how

1078
00:38:08,230 --> 00:38:06,079
we might be able to utilize this tissue

1079
00:38:10,790 --> 00:38:08,240
for those downstream applications

1080
00:38:11,990 --> 00:38:10,800
of cell therapy cell replacement tissue

1081
00:38:13,430 --> 00:38:12,000
replacement

1082
00:38:15,270 --> 00:38:13,440
i think there's a lot we don't

1083
00:38:15,910 --> 00:38:15,280
understand about the microgravity

1084
00:38:18,470 --> 00:38:15,920
environment

1085
00:38:20,950 --> 00:38:18,480
and its impact on the human body and

1086
00:38:22,790 --> 00:38:20,960
importantly we want to figure out

1087
00:38:24,310 --> 00:38:22,800
the beneficial effects that microgravity

1088
00:38:28,390 --> 00:38:24,320

might be able to have on

1089
00:38:32,390 --> 00:38:28,400
human tissue function that makes sense

1090
00:38:33,990 --> 00:38:32,400
um moho gamer on youtube asks if we can

1091
00:38:35,510 --> 00:38:34,000
find a way to make these types of

1092
00:38:37,829 --> 00:38:35,520
tissues will it be

1093
00:38:39,270 --> 00:38:37,839
able to create organs so can i think

1094
00:38:39,750 --> 00:38:39,280
kelsey talked a little bit about this

1095
00:38:41,510 --> 00:38:39,760
but the

1096
00:38:43,270 --> 00:38:41,520
i think the idea here is can we create

1097
00:38:46,470 --> 00:38:43,280
an entire organ

1098
00:38:50,710 --> 00:38:46,480
kelsey do you want to take that one sure

1099
00:38:51,510 --> 00:38:50,720
well eventually i i won't say that we're

1100
00:38:54,150 --> 00:38:51,520
going to

1101
00:38:55,990 --> 00:38:54,160
to create a liver in lab next month um

1102
00:38:57,430 --> 00:38:56,000
that might be a little far out for us

1103
00:38:59,270 --> 00:38:57,440
there are there are several things that

1104
00:39:00,150 --> 00:38:59,280
need to be optimized before then

1105
00:39:02,950 --> 00:39:00,160
including

1106
00:39:03,990 --> 00:39:02,960
for example how do we get enough cells

1107
00:39:07,030 --> 00:39:04,000
to be able to

1108
00:39:07,510 --> 00:39:07,040
print something that large growing cells

1109
00:39:11,109 --> 00:39:07,520
is

1110
00:39:14,310 --> 00:39:11,119
overcome

1111
00:39:18,470 --> 00:39:14,320
next potential nasa challenge um

1112
00:39:20,950 --> 00:39:18,480
but um it certainly is a first step

1113
00:39:21,589 --> 00:39:20,960

and one of the next goals is taking this

1114
00:39:23,349 --> 00:39:21,599
and

1115
00:39:25,589 --> 00:39:23,359
possibly moving on to something bigger

1116
00:39:28,790 --> 00:39:25,599
than a centimeter

1117
00:39:30,710 --> 00:39:28,800
so arun did you have anything to add to

1118
00:39:32,710 --> 00:39:30,720
that

1119
00:39:34,470 --> 00:39:32,720
yeah i'll echo what kelsey just said i

1120
00:39:37,430 --> 00:39:34,480
mean a lot of what we've done here

1121
00:39:39,510 --> 00:39:37,440
is incremental but extremely important

1122
00:39:41,109 --> 00:39:39,520
uh the next step is to make these

1123
00:39:42,870 --> 00:39:41,119
tissues even bigger and better

1124
00:39:44,630 --> 00:39:42,880
larger than one cubic centimeter as

1125
00:39:46,870 --> 00:39:44,640
kelsey had mentioned if

1126
00:39:48,550 --> 00:39:46,880
the organs of the body are of course

1127
00:39:50,870 --> 00:39:48,560
larger than that for the most part

1128
00:39:51,829 --> 00:39:50,880
i think it'd be a dream to perfectly

1129
00:39:54,950 --> 00:39:51,839
replicate

1130
00:39:55,430 --> 00:39:54,960
a truly adult human organ outside of the

1131
00:39:57,510 --> 00:39:55,440
body

1132
00:40:01,349 --> 00:39:57,520
we're not quite there yet but down the

1133
00:40:05,270 --> 00:40:04,790
so sami on facebook asks why did you

1134
00:40:07,270 --> 00:40:05,280
choose

1135
00:40:08,950 --> 00:40:07,280
liver cells and i'll throw that one to

1136
00:40:10,470 --> 00:40:08,960
kelsea and actually i'm very interested

1137
00:40:14,390 --> 00:40:10,480
in the answer to that as well

1138
00:40:15,349 --> 00:40:14,400

why liver cells well there was a lot of

1139
00:40:17,430 --> 00:40:15,359
talk between

1140
00:40:19,829 --> 00:40:17,440
the different samples that we could look

1141
00:40:23,109 --> 00:40:19,839
at nasa and the methuselah foundation

1142
00:40:25,190 --> 00:40:23,119
had outlined five of the major different

1143
00:40:27,349 --> 00:40:25,200
organ types that they would like groups

1144
00:40:30,630 --> 00:40:27,359
to look at including

1145
00:40:33,829 --> 00:40:30,640
liver kidney skeletal muscle

1146
00:40:35,750 --> 00:40:33,839
heart muscle and lung

1147
00:40:37,270 --> 00:40:35,760
and i think one of the reasons we wanted

1148
00:40:40,710 --> 00:40:37,280
to look at liver is

1149
00:40:42,069 --> 00:40:40,720
it is a a large solid organ which means

1150
00:40:45,190 --> 00:40:42,079
that you can

1151
00:40:48,550 --> 00:40:45,200
sort of develop it with relatively

1152
00:40:48,950 --> 00:40:48,560
few really tiny components that you have

1153
00:40:50,069 --> 00:40:48,960
to

1154
00:40:51,430 --> 00:40:50,079
get in there i mean with lung for

1155
00:40:52,950 --> 00:40:51,440
example you have to build in an air

1156
00:40:54,309 --> 00:40:52,960
liquid interface with

1157
00:40:57,349 --> 00:40:54,319
cardiac muscle you need to make sure

1158
00:40:59,910 --> 00:40:57,359
that you can electrically stimulate it

1159
00:41:00,870 --> 00:40:59,920
and so liver kind of acts as a first

1160
00:41:02,710 --> 00:41:00,880
step

1161
00:41:03,990 --> 00:41:02,720
towards being able to move to some of

1162
00:41:06,470 --> 00:41:04,000
these that might have more

1163
00:41:07,910 --> 00:41:06,480

cellularly complex systems while still

1164
00:41:09,670 --> 00:41:07,920
being something that's critically

1165
00:41:11,430 --> 00:41:09,680
important i mean liver failure in our

1166
00:41:13,589 --> 00:41:11,440
country is

1167
00:41:15,270 --> 00:41:13,599
devastating to many many people and so

1168
00:41:17,109 --> 00:41:15,280
it's it's an important step

1169
00:41:21,190 --> 00:41:17,119
and also sets us up for being able to

1170
00:41:23,430 --> 00:41:21,200
succeed with more complicated structures

1171
00:41:24,710 --> 00:41:23,440
our bodies are just amazing it's

1172
00:41:26,150 --> 00:41:24,720
incredible

1173
00:41:28,069 --> 00:41:26,160
i think this would be a good question

1174
00:41:31,750 --> 00:41:28,079
for dr sharma

1175
00:41:33,589 --> 00:41:31,760
hayden ravenscroft on youtube asks

1176
00:41:35,829 --> 00:41:33,599
are there any experiments running on the

1177
00:41:41,670 --> 00:41:35,839
iss or in space

1178
00:41:47,990 --> 00:41:44,950
so right now there

1179
00:41:50,150 --> 00:41:48,000
are not as far as i know there aren't

1180
00:41:52,390 --> 00:41:50,160
any vascularized tissue experiments

1181
00:41:52,870 --> 00:41:52,400
running on station currently but that

1182
00:41:55,430 --> 00:41:52,880
may

1183
00:41:57,030 --> 00:41:55,440
change very soon thanks to the

1184
00:41:58,790 --> 00:41:57,040
tremendous work of kelsey and her

1185
00:42:00,710 --> 00:41:58,800
colleagues

1186
00:42:02,950 --> 00:42:00,720
in most of the work that has been done

1187
00:42:04,630 --> 00:42:02,960
on station has been either in animal

1188
00:42:07,829 --> 00:42:04,640

models or in two dimensional

1189
00:42:09,510 --> 00:42:07,839
cell culture systems and some organ chip

1190
00:42:12,230 --> 00:42:09,520
related systems as well

1191
00:42:15,349 --> 00:42:12,240
three-dimensional vascularized tissue

1192
00:42:17,750 --> 00:42:15,359
for one is very difficult to create so

1193
00:42:18,390 --> 00:42:17,760
this particular challenge was addressing

1194
00:42:19,829 --> 00:42:18,400
that

1195
00:42:21,750 --> 00:42:19,839
can we actually make something like this

1196
00:42:22,630 --> 00:42:21,760
in the first place and the next step of

1197
00:42:24,870 --> 00:42:22,640
this will be

1198
00:42:26,790 --> 00:42:24,880
yes transporting it to the station and

1199
00:42:28,829 --> 00:42:26,800
really utilizing it as an appropriate

1200
00:42:31,750 --> 00:42:28,839
model to study the function of the human

1201
00:42:33,270 --> 00:42:31,760
body

1202
00:42:35,030 --> 00:42:33,280
so we talked a little bit about this

1203
00:42:37,510 --> 00:42:35,040
before kelsey but how did

1204
00:42:38,790 --> 00:42:37,520
covid impact your team's participation

1205
00:42:40,550 --> 00:42:38,800
in the challenge did it

1206
00:42:42,230 --> 00:42:40,560
extend the timeline i know you said

1207
00:42:42,870 --> 00:42:42,240
before that the judges couldn't come out

1208
00:42:45,990 --> 00:42:42,880
and actually

1209
00:42:46,630 --> 00:42:46,000
look at the sample how uh how else did

1210
00:42:48,950 --> 00:42:46,640
your team

1211
00:42:51,750 --> 00:42:48,960
sort of overcome this unprecedented

1212
00:42:55,510 --> 00:42:53,750
well kovic was quite a hurdle i mean

1213
00:42:57,030 --> 00:42:55,520

they actually shut down the lab for

1214
00:42:58,470 --> 00:42:57,040
several months and wouldn't let any of

1215
00:43:00,470 --> 00:42:58,480
us show up although

1216
00:43:02,630 --> 00:43:00,480
i know a few of us may have snuck in

1217
00:43:04,390 --> 00:43:02,640
when we weren't supposed to be there

1218
00:43:06,870 --> 00:43:04,400
it's very hard to let go of research

1219
00:43:10,950 --> 00:43:06,880
that you've spent years working on

1220
00:43:12,470 --> 00:43:10,960
because of outside problems

1221
00:43:14,550 --> 00:43:12,480
i think it gave us a little bit more

1222
00:43:16,390 --> 00:43:14,560
time to plan what our

1223
00:43:18,470 --> 00:43:16,400
you know final judged experiment would

1224
00:43:18,870 --> 00:43:18,480
be like i i know that what you're seeing

1225
00:43:20,950 --> 00:43:18,880
here

1226
00:43:22,470 --> 00:43:20,960
is is one experiment that worked really

1227
00:43:25,670 --> 00:43:22,480
well but this was

1228
00:43:26,150 --> 00:43:25,680
years of progressive failure leading up

1229
00:43:29,109 --> 00:43:26,160
to it

1230
00:43:29,750 --> 00:43:29,119
and you know learning from what didn't

1231
00:43:31,430 --> 00:43:29,760
work well

1232
00:43:33,510 --> 00:43:31,440
to to move forward and so it gave us

1233
00:43:34,630 --> 00:43:33,520
some time to sort of synthesize all of

1234
00:43:38,790 --> 00:43:34,640
that together and

1235
00:43:40,470 --> 00:43:38,800
come up with really how we wanted to

1236
00:43:43,190 --> 00:43:40,480
try to put this all together into a real

1237
00:43:44,790 --> 00:43:43,200
working project

1238
00:43:46,710 --> 00:43:44,800

yeah i think you raise a really

1239
00:43:47,510 --> 00:43:46,720
excellent point we we spoke a little bit

1240
00:43:49,589 --> 00:43:47,520
about this with

1241
00:43:50,630 --> 00:43:49,599
dr sharma where you know just like five

1242
00:43:52,230 --> 00:43:50,640
years um

1243
00:43:53,829 --> 00:43:52,240
this is at least you know his

1244
00:43:54,950 --> 00:43:53,839
participation and this has been an

1245
00:43:58,150 --> 00:43:54,960
ongoing

1246
00:43:59,829 --> 00:43:58,160
sort of um you know

1247
00:44:01,670 --> 00:43:59,839
like failure after failure that

1248
00:44:03,030 --> 00:44:01,680
eventually results in something that

1249
00:44:05,030 --> 00:44:03,040
works and i think that's a really

1250
00:44:07,349 --> 00:44:05,040
important message that like sometimes

1251
00:44:08,470 --> 00:44:07,359
something worth achieving takes a very

1252
00:44:12,950 --> 00:44:08,480
long time

1253
00:44:15,030 --> 00:44:12,960
um but it is worth it in the end um

1254
00:44:15,990 --> 00:44:15,040
what was something that really surprised

1255
00:44:18,550 --> 00:44:16,000
you about your

1256
00:44:19,910 --> 00:44:18,560
results kelsey was you know was ever did

1257
00:44:22,150 --> 00:44:19,920
everything go as expected

1258
00:44:26,309 --> 00:44:22,160
or were you uh kind of surprised by

1259
00:44:30,150 --> 00:44:28,790
i think working with living tissue um

1260
00:44:33,430 --> 00:44:30,160
nothing ever quite goes

1261
00:44:34,710 --> 00:44:33,440
as you expect it to it always does

1262
00:44:36,790 --> 00:44:34,720
something a little bit different than

1263
00:44:38,150 --> 00:44:36,800

you thought it was going to do

1264
00:44:40,150 --> 00:44:38,160
i think one of the things that we were

1265
00:44:41,109 --> 00:44:40,160
really really excited to see with these

1266
00:44:43,030 --> 00:44:41,119
samples

1267
00:44:44,870 --> 00:44:43,040
was the fact that they aggregated so

1268
00:44:47,190 --> 00:44:44,880
well which means that the cells

1269
00:44:47,990 --> 00:44:47,200
came and instead of being individual

1270
00:44:49,670 --> 00:44:48,000
cells

1271
00:44:51,829 --> 00:44:49,680
they really merged together into

1272
00:44:54,870 --> 00:44:51,839
something

1273
00:44:57,030 --> 00:44:54,880
moving towards an organ um where

1274
00:44:58,390 --> 00:44:57,040
it wasn't just cells in a gel it was

1275
00:44:59,589 --> 00:44:58,400
really cells coming together and

1276
00:45:03,270 --> 00:44:59,599
starting to make

1277
00:45:04,950 --> 00:45:03,280
a precursor to tissue um

1278
00:45:06,630 --> 00:45:04,960
and while we were expecting some

1279
00:45:09,349 --> 00:45:06,640
aggregation i think we saw a bit more

1280
00:45:14,309 --> 00:45:11,109
hoping for so it was it was a really

1281
00:45:18,790 --> 00:45:14,319
great thing to see

1282
00:45:20,790 --> 00:45:18,800
great that's a great problem then

1283
00:45:22,150 --> 00:45:20,800
um i think a lot of people are wondering

1284
00:45:25,349 --> 00:45:22,160
for both of you

1285
00:45:26,950 --> 00:45:25,359
how you got into this line of work i

1286
00:45:28,230 --> 00:45:26,960
think sometimes you sort of fall into it

1287
00:45:29,589 --> 00:45:28,240
sometimes it's very intentional

1288
00:45:31,510 --> 00:45:29,599

sometimes it's both

1289
00:45:33,190 --> 00:45:31,520
um starting with you dr sharma how did

1290
00:45:36,790 --> 00:45:33,200
this line of work

1291
00:45:41,190 --> 00:45:39,750
right well i've always had a passion for

1292
00:45:41,990 --> 00:45:41,200
space flight and the intersection of

1293
00:45:44,870 --> 00:45:42,000
biology

1294
00:45:46,950 --> 00:45:44,880
and um and space i actually had the good

1295
00:45:48,950 --> 00:45:46,960
fortune of growing up in huntsville

1296
00:45:50,710 --> 00:45:48,960
alabama which is just down the road from

1297
00:45:54,630 --> 00:45:50,720
the marshall space flight center

1298
00:45:55,750 --> 00:45:54,640
and i think part of it is a a pursuit of

1299
00:45:58,150 --> 00:45:55,760
the unknown

1300
00:45:59,430 --> 00:45:58,160
there's a lot we just don't know about

1301
00:46:01,750 --> 00:45:59,440
how the human body

1302
00:46:02,470 --> 00:46:01,760
is actually impacted by microgravity i

1303
00:46:05,430 --> 00:46:02,480
mean we've

1304
00:46:06,710 --> 00:46:05,440
been in space for a few decades now and

1305
00:46:09,030 --> 00:46:06,720
we have an understanding of the

1306
00:46:11,430 --> 00:46:09,040
physiological changes that happen at the

1307
00:46:12,390 --> 00:46:11,440
the body level but as a cell biologist

1308
00:46:14,309 --> 00:46:12,400
i'm really interested

1309
00:46:15,589 --> 00:46:14,319
in the cells how are the cells of the

1310
00:46:17,589 --> 00:46:15,599
human body how is

1311
00:46:19,829 --> 00:46:17,599
how are the the genetics of the body

1312
00:46:22,230 --> 00:46:19,839
impacted by extended space flight

1313
00:46:24,069 --> 00:46:22,240

and i think you know right now we're

1314
00:46:26,150 --> 00:46:24,079
kind of at a golden age when it comes to

1315
00:46:28,950 --> 00:46:26,160
utilizing the space station to

1316
00:46:30,230 --> 00:46:28,960
better understand some of these uh these

1317
00:46:32,230 --> 00:46:30,240
questions about

1318
00:46:37,670 --> 00:46:32,240
the impact of microgravity on the human

1319
00:46:44,069 --> 00:46:40,950
and what about you kelsey well for me

1320
00:46:45,109 --> 00:46:44,079
i mean i've always loved math and

1321
00:46:46,550 --> 00:46:45,119
science and how

1322
00:46:47,990 --> 00:46:46,560
if something doesn't make sense there

1323
00:46:49,829 --> 00:46:48,000
you just need to dig a little bit deeper

1324
00:46:52,069 --> 00:46:49,839
to find a foundational theorem that sort

1325
00:46:53,670 --> 00:46:52,079
of ties it all together

1326
00:46:55,589 --> 00:46:53,680
being able to take that and move it into

1327
00:46:56,790 --> 00:46:55,599
biomedical engineering was a way to

1328
00:46:59,589 --> 00:46:56,800
bring

1329
00:47:02,069 --> 00:46:59,599
that idea into something that actually

1330
00:47:04,710 --> 00:47:02,079
helped people

1331
00:47:05,670 --> 00:47:04,720
in a really primary way rather than you

1332
00:47:07,190 --> 00:47:05,680
know i mean

1333
00:47:08,870 --> 00:47:07,200
so many different technologies these

1334
00:47:11,910 --> 00:47:08,880
days help people it would be

1335
00:47:12,950 --> 00:47:11,920
crass of me to say that other groups are

1336
00:47:15,589 --> 00:47:12,960
not but

1337
00:47:15,990 --> 00:47:15,599
with biomedical engineering i can really

1338
00:47:18,630 --> 00:47:16,000

see

1339
00:47:20,630 --> 00:47:18,640
the people that i'm helping directly

1340
00:47:22,150 --> 00:47:20,640
with regards to this particular project

1341
00:47:24,069 --> 00:47:22,160
one of the reasons i came back to

1342
00:47:27,829 --> 00:47:24,079
graduate school was

1343
00:47:30,150 --> 00:47:27,839
that i really thought bioprinting was

1344
00:47:30,870 --> 00:47:30,160
one of the ways that we could scale up

1345
00:47:33,430 --> 00:47:30,880
this system

1346
00:47:35,030 --> 00:47:33,440
and actually get it to patients i'd

1347
00:47:37,030 --> 00:47:35,040
spent some time

1348
00:47:38,150 --> 00:47:37,040
doing research where we were making

1349
00:47:40,630 --> 00:47:38,160
different implants

1350
00:47:42,069 --> 00:47:40,640
by hand and that just was never going to

1351
00:47:44,710 --> 00:47:42,079
actually get to people

1352
00:47:45,910 --> 00:47:44,720
in my opinion not in a in a large scale

1353
00:47:49,030 --> 00:47:45,920
way

1354
00:47:50,630 --> 00:47:49,040
and for this particular project i

1355
00:47:53,190 --> 00:47:50,640
can't speak to how each of the other

1356
00:47:55,670 --> 00:47:53,200
team members came on board but

1357
00:47:57,750 --> 00:47:55,680
for me it was when i showed up at school

1358
00:48:00,390 --> 00:47:57,760
and said i wanted to work on bioprinting

1359
00:48:02,150 --> 00:48:00,400
dr tala had asked what system i wanted

1360
00:48:04,829 --> 00:48:02,160
to work on and i said

1361
00:48:05,990 --> 00:48:04,839
do you have an unsolvable problem i like

1362
00:48:10,390 --> 00:48:06,000
those

1363
00:48:13,510 --> 00:48:10,400

he gave me this oh my goodness

1364
00:48:15,349 --> 00:48:13,520
wow that's fantastic uh you know i think

1365
00:48:16,710 --> 00:48:15,359
we're all trying to do our part here and

1366
00:48:19,109 --> 00:48:16,720
we're all trying to do it in the best

1367
00:48:20,549 --> 00:48:19,119
way we know how um

1368
00:48:22,309 --> 00:48:20,559
here's here's a question that i think a

1369
00:48:25,109 --> 00:48:22,319
lot of people are thinking

1370
00:48:25,990 --> 00:48:25,119
um mark hochmeister sorry if i

1371
00:48:28,870 --> 00:48:26,000
pronounced your

1372
00:48:29,670 --> 00:48:28,880
name wrong on facebook says could this

1373
00:48:34,950 --> 00:48:29,680
extend

1374
00:48:37,109 --> 00:48:34,960
our lifespan

1375
00:48:40,870 --> 00:48:37,119
i think either person can maybe speak to

1376
00:48:43,349 --> 00:48:40,880
this we'll start with dr sharma first

1377
00:48:44,790 --> 00:48:43,359
sure well i think that is the dream as

1378
00:48:46,549 --> 00:48:44,800
we have talked about a lot

1379
00:48:48,150 --> 00:48:46,559
here on this segment i mean down the

1380
00:48:51,030 --> 00:48:48,160
road if we can

1381
00:48:51,589 --> 00:48:51,040
perhaps engineer replacement human

1382
00:48:54,390 --> 00:48:51,599
organs

1383
00:48:57,030 --> 00:48:54,400
outside the body then certainly that

1384
00:48:58,870 --> 00:48:57,040
could extend lifespan say if you have a

1385
00:49:00,470 --> 00:48:58,880
failing liver or a failing heart you

1386
00:49:02,069 --> 00:49:00,480
might just be able to replace it

1387
00:49:04,630 --> 00:49:02,079
entirely by growing one

1388
00:49:06,230 --> 00:49:04,640

a personalized organ outside the body so

1389
00:49:08,150 --> 00:49:06,240
this is a this challenge is a really

1390
00:49:11,270 --> 00:49:08,160
important step towards making that dream

1391
00:49:16,870 --> 00:49:14,549
i completely agree with dr sharma

1392
00:49:18,309 --> 00:49:16,880
i don't think this particular construct

1393
00:49:20,870 --> 00:49:18,319
is going to save a life

1394
00:49:21,910 --> 00:49:20,880
the way that it is but i'm really

1395
00:49:24,790 --> 00:49:21,920
excited that it's

1396
00:49:27,030 --> 00:49:24,800
you know a step towards moving to full

1397
00:49:29,030 --> 00:49:27,040
organs or potentially developing

1398
00:49:30,069 --> 00:49:29,040
new medicines and new treatment plans

1399
00:49:33,670 --> 00:49:30,079
that could help

1400
00:49:34,470 --> 00:49:33,680
with saving people so i think what we're

1401
00:49:37,109 --> 00:49:34,480
saying to mark

1402
00:49:40,630 --> 00:49:37,119
is let's get this sucker on the iss and

1403
00:49:46,069 --> 00:49:44,790
um yeah okay so i'm curious what are the

1404
00:49:48,390 --> 00:49:46,079
current limitations

1405
00:49:50,150 --> 00:49:48,400
to uh on creating new tissue and i think

1406
00:49:52,150 --> 00:49:50,160
you probably both could speak to this

1407
00:49:53,589 --> 00:49:52,160
you know like you said before this was a

1408
00:49:56,150 --> 00:49:53,599
process that took years

1409
00:49:58,230 --> 00:49:56,160
in the making what kind of pain you know

1410
00:50:01,030 --> 00:49:58,240
i can't imagine where one begins

1411
00:50:01,750 --> 00:50:01,040
um to do this sort of task but like what

1412
00:50:03,910 --> 00:50:01,760
kinds of

1413
00:50:07,670 --> 00:50:03,920

limitations exist when you're trying to

1414
00:50:10,710 --> 00:50:09,349
um well i can take a stab at that

1415
00:50:13,829 --> 00:50:10,720
question

1416
00:50:15,270 --> 00:50:13,839
there's quite a few um i think

1417
00:50:17,030 --> 00:50:15,280
the the very first one you have to start

1418
00:50:19,349 --> 00:50:17,040
with is creating an environment that the

1419
00:50:21,990 --> 00:50:19,359
cells are really going to be happy in

1420
00:50:23,349 --> 00:50:22,000
and there are so many different factors

1421
00:50:24,710 --> 00:50:23,359
that lead into that

1422
00:50:26,790 --> 00:50:24,720
different cells like different

1423
00:50:28,309 --> 00:50:26,800
stiffnesses different cells

1424
00:50:30,549 --> 00:50:28,319
like different amounts of different

1425
00:50:32,870 --> 00:50:30,559
chemicals to help stimulate them and

1426
00:50:35,990 --> 00:50:32,880
make them mature into certain ways

1427
00:50:36,630 --> 00:50:36,000
and so i mean for example in this tissue

1428
00:50:38,230 --> 00:50:36,640
we used

1429
00:50:39,829 --> 00:50:38,240
two different cell types endothelial

1430
00:50:41,750 --> 00:50:39,839
cells which make up your blood vessels

1431
00:50:43,589 --> 00:50:41,760
and hepatocytes which are the primary

1432
00:50:45,829 --> 00:50:43,599
cell found in your liver

1433
00:50:47,109 --> 00:50:45,839
and endothelial cells need very

1434
00:50:49,750 --> 00:50:47,119
different growth factors

1435
00:50:50,549 --> 00:50:49,760
than hepatocytes so we had to start

1436
00:50:53,109 --> 00:50:50,559
blending

1437
00:50:54,069 --> 00:50:53,119
different medias together to create a

1438
00:50:56,069 --> 00:50:54,079

you know substrate

1439
00:50:58,549 --> 00:50:56,079
that would feed both of them and keep

1440
00:51:00,790 --> 00:50:58,559
them both functional

1441
00:51:04,150 --> 00:51:00,800
developing a system that creates flow

1442
00:51:06,710 --> 00:51:04,160
and then as i alluded to earlier

1443
00:51:07,510 --> 00:51:06,720
your liver or really any one of your

1444
00:51:09,910 --> 00:51:07,520
organs

1445
00:51:10,549 --> 00:51:09,920
consist of billions and billions of

1446
00:51:14,870 --> 00:51:10,559
cells

1447
00:51:17,589 --> 00:51:14,880
in the lab is

1448
00:51:19,109 --> 00:51:17,599
is really difficult so being able to

1449
00:51:22,390 --> 00:51:19,119
scale up and

1450
00:51:25,430 --> 00:51:22,400
create that number of cells without

1451
00:51:28,230 --> 00:51:25,440
you know months of growth protocols

1452
00:51:30,150 --> 00:51:28,240
or a scientist like me going in and

1453
00:51:33,109 --> 00:51:30,160
feeding them every couple of days with

1454
00:51:37,109 --> 00:51:33,119
tons and tons of media is an important

1455
00:51:42,309 --> 00:51:37,119
thing that we need to overcome

1456
00:51:48,309 --> 00:51:45,990
go ahead i think um i think kelsey is

1457
00:51:51,510 --> 00:51:48,319
totally right here and in addition to

1458
00:51:53,990 --> 00:51:51,520
those issues of functionality survival

1459
00:51:55,510 --> 00:51:54,000
one thing that we're still grappling

1460
00:51:56,870 --> 00:51:55,520
with now and something that wasn't

1461
00:51:58,069 --> 00:51:56,880
really addressed at all in this

1462
00:52:00,470 --> 00:51:58,079
particular challenge

1463
00:52:01,109 --> 00:52:00,480

was appropriately integrating these

1464
00:52:04,230 --> 00:52:01,119
tissues

1465
00:52:06,870 --> 00:52:04,240
into the body so if we were to make say

1466
00:52:08,230 --> 00:52:06,880
a liver outside of the body how do we

1467
00:52:10,470 --> 00:52:08,240
ensure that once we

1468
00:52:11,990 --> 00:52:10,480
put it back into the body it's going to

1469
00:52:14,309 --> 00:52:12,000
function appropriately

1470
00:52:15,109 --> 00:52:14,319
integrate into the host's own vascular

1471
00:52:17,030 --> 00:52:15,119
network

1472
00:52:18,309 --> 00:52:17,040
and integrate with the host's immune

1473
00:52:21,430 --> 00:52:18,319
system as well

1474
00:52:22,230 --> 00:52:21,440
these are incredibly challenging issues

1475
00:52:24,309 --> 00:52:22,240
but i think

1476
00:52:28,710 --> 00:52:24,319
kelsey and your team it's you're going

1477
00:52:32,309 --> 00:52:31,030
yeah sounds like it lots of work that's

1478
00:52:35,670 --> 00:52:32,319
still ahead of you

1479
00:52:37,270 --> 00:52:35,680
but all good stuff um we're coming to a

1480
00:52:38,150 --> 00:52:37,280
close here but i want to ask a couple

1481
00:52:40,790 --> 00:52:38,160
more questions

1482
00:52:41,910 --> 00:52:40,800
um dr sharma what was the what was the

1483
00:52:43,430 --> 00:52:41,920
most important thing to you about

1484
00:52:44,630 --> 00:52:43,440
participating in this challenge we we

1485
00:52:45,670 --> 00:52:44,640
talked to you a little bit about what it

1486
00:52:47,349 --> 00:52:45,680
personally

1487
00:52:49,270 --> 00:52:47,359
meant but um you know this is something

1488
00:52:52,710 --> 00:52:49,280

that we said before you've dedicated now

1489
00:52:56,470 --> 00:52:52,720
nearly five years to um this

1490
00:53:01,030 --> 00:52:58,390
yeah it's a it's a fantastic question i

1491
00:53:02,470 --> 00:53:01,040
think i think again it comes back to

1492
00:53:03,829 --> 00:53:02,480
pushing the boundaries of science i

1493
00:53:05,829 --> 00:53:03,839
think part of the reason

1494
00:53:07,349 --> 00:53:05,839
you're interested in science you get

1495
00:53:09,750 --> 00:53:07,359
into it in the first place

1496
00:53:12,069 --> 00:53:09,760
is perhaps you want to make a benefit

1497
00:53:15,109 --> 00:53:12,079
for human health and you want to improve

1498
00:53:16,630 --> 00:53:15,119
lives down the road and to me i mean i

1499
00:53:18,230 --> 00:53:16,640
was a judge in this challenge i wasn't

1500
00:53:18,870 --> 00:53:18,240
actually participating unlike kelsey and

1501
00:53:20,950 --> 00:53:18,880
her team

1502
00:53:22,630 --> 00:53:20,960
but for me as a judge it was really

1503
00:53:24,630 --> 00:53:22,640
rewarding to see

1504
00:53:26,069 --> 00:53:24,640
the the work that kelsey and her team

1505
00:53:27,109 --> 00:53:26,079
and other teams around the country were

1506
00:53:29,030 --> 00:53:27,119
doing to help

1507
00:53:30,549 --> 00:53:29,040
perhaps you know address this unmet

1508
00:53:32,790 --> 00:53:30,559
medical need of

1509
00:53:34,870 --> 00:53:32,800
replacement human organs it's it's a

1510
00:53:36,790 --> 00:53:34,880
vision and a goal that we all want to

1511
00:53:39,030 --> 00:53:36,800
strive for in this field

1512
00:53:41,109 --> 00:53:39,040
and that's why something like this is so

1513
00:53:42,950 --> 00:53:41,119

critically important because

1514
00:53:44,390 --> 00:53:42,960
challenges like these and experiments

1515
00:53:46,630 --> 00:53:44,400
and projects like these

1516
00:53:48,390 --> 00:53:46,640
are going to make that vision a reality

1517
00:53:50,630 --> 00:53:48,400
down the road so it was

1518
00:53:53,430 --> 00:53:50,640
it was very rewarding to be a part of

1519
00:53:56,630 --> 00:53:55,349
oh i felt that one that was a great

1520
00:53:58,630 --> 00:53:56,640
answer um

1521
00:53:59,829 --> 00:53:58,640
okay so we've got we've got a very

1522
00:54:01,829 --> 00:53:59,839
practical person

1523
00:54:03,109 --> 00:54:01,839
here answer asking this question and

1524
00:54:05,990 --> 00:54:03,119
we'll just do um

1525
00:54:06,870 --> 00:54:06,000
quick answers from you both what advice

1526
00:54:09,829 --> 00:54:06,880
would you give

1527
00:54:10,390 --> 00:54:09,839
to future solvers interested in a nasa

1528
00:54:13,270 --> 00:54:10,400
challenge

1529
00:54:15,270 --> 00:54:13,280
so from both the participant side and

1530
00:54:18,950 --> 00:54:15,280
also the judge's side quick answers

1531
00:54:23,270 --> 00:54:22,309
well i would say a passion for the field

1532
00:54:25,270 --> 00:54:23,280
a passion for

1533
00:54:27,430 --> 00:54:25,280
what you're doing you don't necessarily

1534
00:54:30,950 --> 00:54:27,440
have to be directly involved

1535
00:54:33,030 --> 00:54:30,960
in space science i think being

1536
00:54:34,150 --> 00:54:33,040
passionate about engineering passion

1537
00:54:36,390 --> 00:54:34,160
about biology is

1538
00:54:37,430 --> 00:54:36,400

is critically important for success in

1539
00:54:44,470 --> 00:54:37,440
this challenge or

1540
00:54:48,630 --> 00:54:46,870
i completely agree with dr sharma

1541
00:54:50,549 --> 00:54:48,640
passion is definitely one of the most

1542
00:54:51,750 --> 00:54:50,559
important things

1543
00:54:53,589 --> 00:54:51,760
learning how to give up a little bit of

1544
00:54:55,829 --> 00:54:53,599
sleep for a while is probably also

1545
00:54:57,270 --> 00:54:55,839
pretty critical uh make sure you can get

1546
00:54:59,589 --> 00:54:57,280
all the athletes done

1547
00:55:01,990 --> 00:54:59,599
and you know get everything turned in on

1548
00:55:06,710 --> 00:55:04,829
hey that's the reason i appreciate your

1549
00:55:09,430 --> 00:55:06,720
realism

1550
00:55:10,870 --> 00:55:09,440
um well on that note that is all the

1551
00:55:12,870 --> 00:55:10,880
time we have for today

1552
00:55:15,109 --> 00:55:12,880
thank you so much to you dr sharma for

1553
00:55:17,829 --> 00:55:15,119
being here

1554
00:55:19,990 --> 00:55:17,839
thank you so much for having me and

1555
00:55:23,510 --> 00:55:20,000
congratulations again kelsey and

1556
00:55:25,910 --> 00:55:23,520
to your entire team congratulations

1557
00:55:27,030 --> 00:55:25,920
thank you so much um i'm honored to be

1558
00:55:29,190 --> 00:55:27,040
here as a representative

1559
00:55:30,470 --> 00:55:29,200
and it's certainly been you know a major

1560
00:55:33,109 --> 00:55:30,480
team effort

1561
00:55:34,950 --> 00:55:33,119
very exciting to be honored in such a

1562
00:55:38,470 --> 00:55:34,960
way

1563
00:55:40,230 --> 00:55:38,480

absolutely so today we learned all about

1564
00:55:42,390 --> 00:55:40,240
vascularized human tissue

1565
00:55:43,430 --> 00:55:42,400
the very existence of which we need to

1566
00:55:45,270 --> 00:55:43,440
survive

1567
00:55:46,710 --> 00:55:45,280
we met the very first scientists to

1568
00:55:49,589 --> 00:55:46,720
create thick functional

1569
00:55:51,510 --> 00:55:49,599
vascularized human tissue in a lab we

1570
00:55:54,549 --> 00:55:51,520
have explored the many benefits of this

1571
00:55:56,390 --> 00:55:54,559
technology both on earth and in space

1572
00:55:57,910 --> 00:55:56,400
now let's imagine the possibilities for

1573
00:55:59,349 --> 00:55:57,920
what's next

1574
00:56:01,349 --> 00:55:59,359
we're also excited to announce that the

1575
00:56:02,630 --> 00:56:01,359
judges have confirmed a second place

1576
00:56:05,430 --> 00:56:02,640
winner as well

1577
00:56:07,349 --> 00:56:05,440
team w firm also from the wake forest

1578
00:56:08,789 --> 00:56:07,359
institute of regenerative medicine has

1579
00:56:11,990 --> 00:56:08,799
taken the second place

1580
00:56:13,190 --> 00:56:12,000
prize winning 100 thousand dollars not

1581
00:56:15,510 --> 00:56:13,200
too shabby

1582
00:56:16,870 --> 00:56:15,520
so congratulations to them you can learn

1583
00:56:19,430 --> 00:56:16,880
more about team winston

1584
00:56:21,030 --> 00:56:19,440
and tmw firm technologies as well as

1585
00:56:22,230 --> 00:56:21,040
other competitors in the challenge

1586
00:56:25,670 --> 00:56:22,240
during a virtual

1587
00:56:27,910 --> 00:56:25,680
alive virtual summit coming in august

1588
00:56:29,270 --> 00:56:27,920

follow at nasa prize on twitter and

1589
00:56:32,069 --> 00:56:29,280
instagram for details

1590
00:56:34,069 --> 00:56:32,079
coming soon and the vascular tissue

1591
00:56:35,670 --> 00:56:34,079
challenge is just one of many challenges

1592
00:56:38,069 --> 00:56:35,680
going on at nasa right now

1593
00:56:39,829 --> 00:56:38,079
crowdsourcing ideas through competitions

1594
00:56:41,990 --> 00:56:39,839
is one of the many ways nasa

1595
00:56:43,589 --> 00:56:42,000
advances technologies and solves

1596
00:56:45,109 --> 00:56:43,599
difficult problems

1597
00:56:46,630 --> 00:56:45,119
some of these challenges are going or

1598
00:56:47,349 --> 00:56:46,640
some of the challenges going on right

1599
00:56:50,789 --> 00:56:47,359
now

1600
00:56:51,990 --> 00:56:50,799
are the deep space food challenge nasa

1601
00:56:54,710 --> 00:56:52,000
tech rise

1602
00:56:55,430 --> 00:56:54,720
the break the ice challenge and so much

1603
00:56:57,190 --> 00:56:55,440
more

1604
00:56:58,750 --> 00:56:57,200
see all of these opportunities for how

1605
00:57:01,670 --> 00:56:58,760
you can get involved at

1606
00:57:03,829 --> 00:57:01,680
nasa.gov backslash solve

1607
00:57:12,070 --> 00:57:03,839
for nasa science live i'm your host

1608
00:57:27,130 --> 00:57:12,080
lauren ward