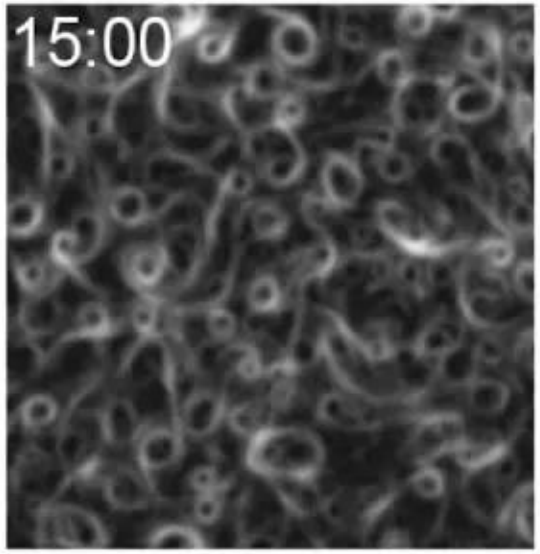
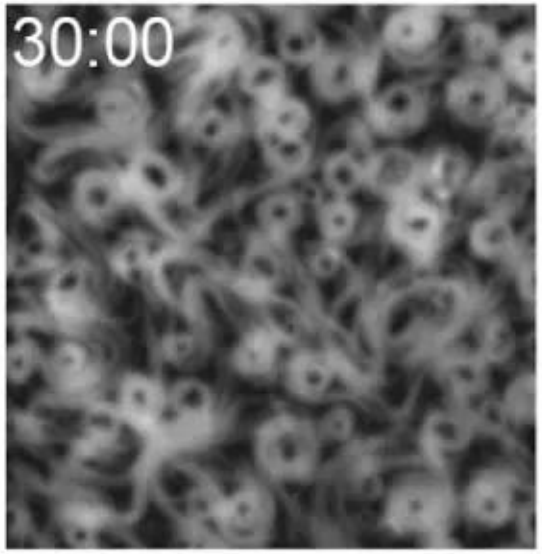
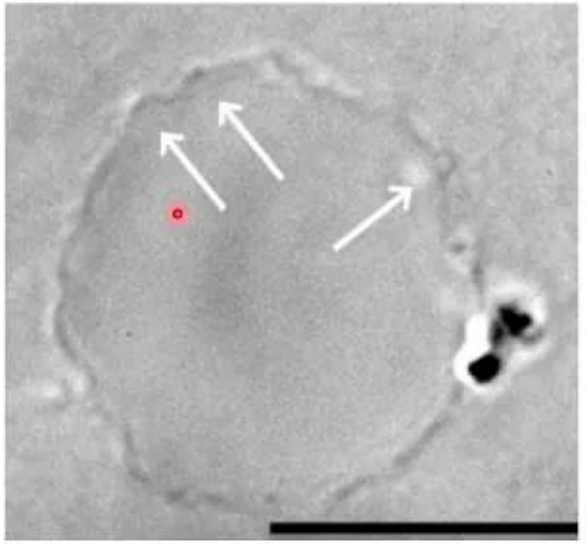
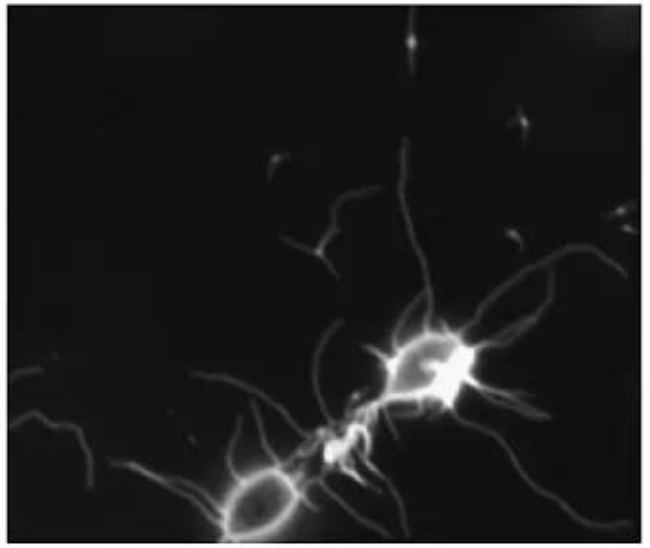
As a plausible candidate for division









Supported Lipid Bilayers

Liposomes(e.g. GUVs)

Ramirez-Diaz DA. et al. *PLoS Biol.* 2018
Osawa M. et al. *Science*. 2008
Osawa M. et al. *EMBO J.* 2009

1
00:00:11,990 --> 00:00:09,910
the theory of a biogenesis states

2
00:00:13,990 --> 00:00:12,000
that life could have originated from

3
00:00:16,230 --> 00:00:14,000
non-living organic molecules

4
00:00:17,109 --> 00:00:16,240
present on earth during the prebiotic

5
00:00:19,349 --> 00:00:17,119
time

6
00:00:20,630 --> 00:00:19,359
the first cell like structures that were

7
00:00:23,109 --> 00:00:20,640
possibly made out of these

8
00:00:24,870 --> 00:00:23,119
organic molecules are called the

9
00:00:26,870 --> 00:00:24,880
protocells

10
00:00:28,630 --> 00:00:26,880
the membrane component of this process

11
00:00:29,669 --> 00:00:28,640
might have emerged from amphiphilic

12
00:00:31,509 --> 00:00:29,679
molecules

13
00:00:33,430 --> 00:00:31,519

which could have spontaneously assembled

14
00:00:35,430 --> 00:00:33,440
into vesicles and encapsulated the

15
00:00:39,910 --> 00:00:35,440
chemical systems that are required for

16
00:00:44,229 --> 00:00:42,389
protocols if knee if it needs to be

17
00:00:46,549 --> 00:00:44,239
considered as a cell

18
00:00:48,470 --> 00:00:46,559
keeping aside all other other cellular

19
00:00:50,950 --> 00:00:48,480
aspects or characteristics

20
00:00:52,389 --> 00:00:50,960
should have the ability to grow and

21
00:00:54,150 --> 00:00:52,399
divide

22
00:00:55,830 --> 00:00:54,160
there are various proposed methods by

23
00:00:57,110 --> 00:00:55,840
which a producer could grow and

24
00:00:59,750 --> 00:00:57,120
eventually divide

25
00:01:01,349 --> 00:00:59,760
it could happen via the addition of

26
00:01:02,790 --> 00:01:01,359
fatty acid precursors

27
00:01:05,189 --> 00:01:02,800
that are released from either

28
00:01:08,310 --> 00:01:05,199
surrounding mycel or

29
00:01:09,429 --> 00:01:08,320
other vesicles and then after the growth

30
00:01:11,990 --> 00:01:09,439
of the protocell

31
00:01:12,630 --> 00:01:12,000
spontaneous division could have been

32
00:01:15,350 --> 00:01:12,640
occurring

33
00:01:18,390 --> 00:01:15,360
in the early times as the only means of

34
00:01:20,070 --> 00:01:18,400
protester cytokinesis

35
00:01:22,310 --> 00:01:20,080
and this could again happen due to

36
00:01:24,149 --> 00:01:22,320
various factors or reasons

37
00:01:27,109 --> 00:01:24,159
like internal forces which includes

38
00:01:28,070 --> 00:01:27,119

osmetic pressure or mechanical forces

39
00:01:30,630 --> 00:01:28,080
which can lead

40
00:01:34,310 --> 00:01:30,640
to pearling in stability as shown in the

41
00:01:37,910 --> 00:01:36,149
to become a modern cell the

42
00:01:39,670 --> 00:01:37,920
protocellular compartments

43
00:01:40,950 --> 00:01:39,680
must have made the switch or a

44
00:01:43,350 --> 00:01:40,960
transition

45
00:01:44,069 --> 00:01:43,360
from having fat gases as their membrane

46
00:01:47,270 --> 00:01:44,079
molecules

47
00:01:49,510 --> 00:01:47,280
to phospholipids as shown in as the

48
00:01:51,030 --> 00:01:49,520
green molecule

49
00:01:53,270 --> 00:01:51,040
with phospholipid addition to the

50
00:01:55,670 --> 00:01:53,280
vesicle the growth of these

51
00:01:57,429 --> 00:01:55,680
mixed lipid vesicles would have

52
00:01:59,109 --> 00:01:57,439
increased in comparison

53
00:02:00,469 --> 00:01:59,119
to the vesicles which are only having

54
00:02:02,709 --> 00:02:00,479
fatty acids

55
00:02:05,429 --> 00:02:02,719
and then did the increase of the

56
00:02:07,030 --> 00:02:05,439
strength of these membranes

57
00:02:09,830 --> 00:02:07,040
within with the increase of

58
00:02:14,470 --> 00:02:09,840
phospholipids the spontaneous division

59
00:02:17,430 --> 00:02:14,480
have a less chance of occurring which

60
00:02:17,910 --> 00:02:17,440
eventually leads to the formation of new

61
00:02:20,470 --> 00:02:17,920
genes

62
00:02:21,510 --> 00:02:20,480
and catalysts which would have evolved

63
00:02:25,910 --> 00:02:21,520

to make

64
00:02:30,150 --> 00:02:28,309
but which catalytic mechanism would have

65
00:02:32,470 --> 00:02:30,160
led to the division of the protester

66
00:02:33,430 --> 00:02:32,480
so there is an idea which proposed that

67
00:02:36,550 --> 00:02:33,440
maybe some

68
00:02:38,470 --> 00:02:36,560
extent enzyme that are needed for

69
00:02:40,710 --> 00:02:38,480
lipid synthesis could have led to the

70
00:02:44,150 --> 00:02:40,720
growth and the division of protolouses

71
00:02:48,470 --> 00:02:44,160
however till date no such enzyme was

72
00:02:51,750 --> 00:02:48,480
found hence a new hypothesis

73
00:02:53,430 --> 00:02:51,760
was made which states that

74
00:02:55,990 --> 00:02:53,440
maybe the lipid synthesis could have

75
00:02:58,869 --> 00:02:56,000
started in an external environment

76
00:03:00,149 --> 00:02:58,879
rather than an internal one and later

77
00:03:02,229 --> 00:03:00,159
some ancient enzyme

78
00:03:03,350 --> 00:03:02,239
or proteins may have assisted in the

79
00:03:05,270 --> 00:03:03,360
division of the cells

80
00:03:08,470 --> 00:03:05,280
after it has acquired the necessary

81
00:03:11,910 --> 00:03:10,229
before going into the catalyst spot i

82
00:03:14,790 --> 00:03:11,920
would like to mention the advantages of

83
00:03:16,390 --> 00:03:14,800
having a periodically timed division

84
00:03:19,110 --> 00:03:16,400
the cells controlling the timing of

85
00:03:19,830 --> 00:03:19,120
cytokinesis by any enzyme or early

86
00:03:21,750 --> 00:03:19,840
protein

87
00:03:23,110 --> 00:03:21,760
could have gained the advantage of

88
00:03:25,670 --> 00:03:23,120

coordinating the inf

89
00:03:27,190 --> 00:03:25,680
the replication timing of informational

90
00:03:30,229 --> 00:03:27,200
molecule

91
00:03:31,030 --> 00:03:30,239
with the early cell membrane burning

92
00:03:33,270 --> 00:03:31,040
process

93
00:03:34,229 --> 00:03:33,280
in order to successfully and efficiently

94
00:03:35,910 --> 00:03:34,239
transfer

95
00:03:37,750 --> 00:03:35,920
all of its genetic information and

96
00:03:41,990 --> 00:03:37,760
metabolic molecules equally to

97
00:03:46,630 --> 00:03:46,070
this has led to our hypothesis where we

98
00:03:49,430 --> 00:03:46,640
think

99
00:03:50,630 --> 00:03:49,440
that fjse might be the early protein

100
00:03:52,949 --> 00:03:50,640
which is needed

101
00:03:54,070 --> 00:03:52,959
for the process of division of the

102
00:03:57,110 --> 00:03:54,080
producer

103
00:03:58,229 --> 00:03:57,120
so what is fdac actually safeties is a

104
00:04:00,949 --> 00:03:58,239
gdps

105
00:04:03,190 --> 00:04:00,959
protein encoded by fdazi gene that

106
00:04:04,869 --> 00:04:03,200
assembles into a ring-like structure

107
00:04:07,830 --> 00:04:04,879
the future site of bacterial cell

108
00:04:08,630 --> 00:04:07,840
division fda is found in almost all

109
00:04:11,270 --> 00:04:08,640
bacteria

110
00:04:11,830 --> 00:04:11,280
archaea chloroplast and mitochondria

111
00:04:13,509 --> 00:04:11,840
that is

112
00:04:17,110 --> 00:04:13,519
very much essential for cell division

113
00:04:20,390 --> 00:04:17,120

process fds is also an ancient protein

114
00:04:22,150 --> 00:04:20,400
it contains very less amount of amino

115
00:04:25,590 --> 00:04:22,160
acids like arginine lysine

116
00:04:28,150 --> 00:04:25,600
phenylalanine etc which were

117
00:04:29,430 --> 00:04:28,160
hypothesized to be the last one to be

118
00:04:32,310 --> 00:04:29,440
added to the genetic code

119
00:04:34,070 --> 00:04:32,320
hence it suggests that fdac evolved as a

120
00:04:36,310 --> 00:04:34,080
functional protein way before the

121
00:04:39,030 --> 00:04:36,320
genetic code was even complete

122
00:04:40,150 --> 00:04:39,040
and fdac is the only gene controlling

123
00:04:41,909 --> 00:04:40,160
cellular division

124
00:04:44,310 --> 00:04:41,919
present in all resident minimal

125
00:04:47,749 --> 00:04:44,320
bacterial genome that are being analyzed

126
00:04:52,070 --> 00:04:50,710
the activity of ftec on various in vitra

127
00:04:54,150 --> 00:04:52,080
and in vivo system

128
00:04:56,230 --> 00:04:54,160
which mimics the protozoa structure has

129
00:04:59,030 --> 00:04:56,240
been already observed

130
00:05:00,390 --> 00:04:59,040
like for example here in the case of uni

131
00:05:03,270 --> 00:05:00,400
laminar vesicles

132
00:05:06,070 --> 00:05:03,280
the filaments of fdaz form patches

133
00:05:07,909 --> 00:05:06,080
inside the liposomes and these patches

134
00:05:09,510 --> 00:05:07,919
are reorganized to form ring-like

135
00:05:11,029 --> 00:05:09,520
structures which are parallel to the

136
00:05:12,790 --> 00:05:11,039
plane of the membrane

137
00:05:15,029 --> 00:05:12,800
some projections were observed at the

138
00:05:15,350 --> 00:05:15,039

outer portion of the vesicle like birds

139
00:05:17,189 --> 00:05:15,360
or

140
00:05:19,830 --> 00:05:17,199
tubules and the position of the

141
00:05:21,350 --> 00:05:19,840
projections is actually coinciding with

142
00:05:22,550 --> 00:05:21,360
that of the rings of the patches that

143
00:05:24,310 --> 00:05:22,560
are made by fdaz

144
00:05:25,749 --> 00:05:24,320
which shows that rings that are made by

145
00:05:26,790 --> 00:05:25,759
fdasi are able to construct the

146
00:05:29,110 --> 00:05:26,800
membranes

147
00:05:30,870 --> 00:05:29,120
of the vesicles partially which could be

148
00:05:32,390 --> 00:05:30,880
a cue for protocellular division

149
00:05:34,550 --> 00:05:32,400
and the similar things has been observed

150
00:05:39,749 --> 00:05:34,560
in other in vitro systems as well

151
00:05:42,469 --> 00:05:39,759
like slbs or supported lipid bilayers

152
00:05:44,469 --> 00:05:42,479
these model systems along with fdac

153
00:05:46,390 --> 00:05:44,479
could be able to resemble the divisional

154
00:05:47,909 --> 00:05:46,400
machinery that were present in primitive

155
00:05:49,909 --> 00:05:47,919
cells and help us understand the

156
00:05:52,469 --> 00:05:49,919
replication pathway

157
00:05:53,270 --> 00:05:52,479
therefore our project or our work is

158
00:05:55,990 --> 00:05:53,280
focused

159
00:05:58,309 --> 00:05:56,000
on the reconstitution of fdac on various

160
00:05:58,790 --> 00:05:58,319
relevant in vitro and in vivo systems

161
00:06:01,510 --> 00:05:58,800
like

162
00:06:03,270 --> 00:06:01,520
liposomes and others while observing its

163
00:06:08,469 --> 00:06:03,280

dynamics and the ability to

164
00:06:13,110 --> 00:06:11,350
fda fdz usually binds to the membrane

165
00:06:16,230 --> 00:06:13,120
not directly with the help

166
00:06:20,469 --> 00:06:16,240
of another protein which is either

167
00:06:26,790 --> 00:06:20,479
an fds a or zepa and it binds to this

168
00:06:30,710 --> 00:06:28,550
so before adding the protein on the

169
00:06:33,350 --> 00:06:30,720
invitro systems and doing the studies

170
00:06:34,629 --> 00:06:33,360
we have changed some tips and bits of

171
00:06:36,309 --> 00:06:34,639
the protein

172
00:06:38,710 --> 00:06:36,319
which could help us visualize the

173
00:06:40,469 --> 00:06:38,720
protein better on these systems

174
00:06:43,029 --> 00:06:40,479
so this is a construct or one can say a

175
00:06:45,909 --> 00:06:43,039
plasmid map containing the genes

176
00:06:46,790 --> 00:06:45,919
that our design protein is having so

177
00:06:49,830 --> 00:06:46,800
instead of

178
00:06:51,029 --> 00:06:49,840
having a zip a or fdsa as a membrane

179
00:06:54,150 --> 00:06:51,039
anchorage protein

180
00:06:56,629 --> 00:06:54,160
we are using e coli mindy mts

181
00:06:59,029 --> 00:06:56,639
so fdsa had a profound effect on the

182
00:07:00,950 --> 00:06:59,039
dynamics of fdaz when both of them were

183
00:07:03,029 --> 00:07:00,960
reconstituted in phospholipid

184
00:07:04,950 --> 00:07:03,039
vesicles which overshadows its

185
00:07:06,629 --> 00:07:04,960
capabilities and functionalities

186
00:07:09,110 --> 00:07:06,639
hence it has been replaced by a

187
00:07:10,950 --> 00:07:09,120
non-interacting membrane binding protein

188
00:07:13,270 --> 00:07:10,960

which is mts

189
00:07:15,350 --> 00:07:13,280
and therefore the c-terminal region of

190
00:07:17,830 --> 00:07:15,360
ftse is not needed hence

191
00:07:18,790 --> 00:07:17,840
the plasmid contains fdac without a c

192
00:07:21,990 --> 00:07:18,800
terminal

193
00:07:23,270 --> 00:07:22,000
and mts and a fluorescent tag which is

194
00:07:25,430 --> 00:07:23,280
amnion

195
00:07:27,110 --> 00:07:25,440
in addition to this we also constructed

196
00:07:29,749 --> 00:07:27,120
two other plasmids

197
00:07:31,430 --> 00:07:29,759
and constructs that are having gtps

198
00:07:34,629 --> 00:07:31,440
mutant version of fdac

199
00:07:36,309 --> 00:07:34,639
to see how gdps mutants can actually

200
00:07:39,670 --> 00:07:36,319
affect the protocellular division

201
00:07:43,749 --> 00:07:42,150
after the construction of the constructs

202
00:07:46,230 --> 00:07:43,759
the protein is harvested

203
00:07:46,950 --> 00:07:46,240
and purified from competent strains of e

204
00:07:50,469 --> 00:07:46,960
coli

205
00:07:53,749 --> 00:07:50,479
because stringent purification processes

206
00:07:56,790 --> 00:07:53,759
the protein is usually checked

207
00:07:59,430 --> 00:07:56,800
first before any further

208
00:08:01,430 --> 00:07:59,440
downstream processes are been done on it

209
00:08:03,510 --> 00:08:01,440
we perform the sedimentation assay for

210
00:08:05,270 --> 00:08:03,520
the purpose of checking the activity

211
00:08:06,629 --> 00:08:05,280
a sedimentation assay is nothing but an

212
00:08:08,390 --> 00:08:06,639
inviter asset to observe the

213
00:08:09,110 --> 00:08:08,400

polymerization of the protein here in

214
00:08:11,029 --> 00:08:09,120
our case

215
00:08:13,430 --> 00:08:11,039
the protein if active should be able to

216
00:08:15,189 --> 00:08:13,440
form long filaments when gdp is added

217
00:08:17,350 --> 00:08:15,199
and if in the meantime the reaction is

218
00:08:19,189 --> 00:08:17,360
centrifuged under high speeds

219
00:08:20,629 --> 00:08:19,199
then filament should go down in the

220
00:08:22,230 --> 00:08:20,639
pellet section showing as the presence

221
00:08:25,990 --> 00:08:22,240
of polymerization

222
00:08:27,749 --> 00:08:26,000
and here one can see that that fdac

223
00:08:29,670 --> 00:08:27,759
is being polymerized or being active

224
00:08:31,589 --> 00:08:29,680
even our protein even our

225
00:08:32,709 --> 00:08:31,599
even after our protein purification

226
00:08:34,469 --> 00:08:32,719
process

227
00:08:36,630 --> 00:08:34,479
the amount of pellet in the presence of

228
00:08:40,070 --> 00:08:36,640
gdp as shown in this lane

229
00:08:43,269 --> 00:08:40,080
and this lane is way higher than the one

230
00:08:45,190 --> 00:08:43,279
having the control one having no gdp as

231
00:08:49,030 --> 00:08:45,200
shown in the lane seven

232
00:08:51,350 --> 00:08:49,040
and also the concentration of the ftsd

233
00:08:53,350 --> 00:08:51,360
in the pellet increases both with

234
00:08:58,710 --> 00:08:53,360
increase in fdac concentration

235
00:09:02,550 --> 00:09:01,430
the first system that we used is that of

236
00:09:05,509 --> 00:09:02,560
speroblast

237
00:09:07,509 --> 00:09:05,519
so it is a bacterial bacterial cell or

238
00:09:07,990 --> 00:09:07,519

plant cell that is bound by its plasma

239
00:09:10,389 --> 00:09:08,000
membrane

240
00:09:11,350 --> 00:09:10,399
only and without a cell wall this could

241
00:09:14,470 --> 00:09:11,360
stand as a

242
00:09:15,350 --> 00:09:14,480
model cellular system during which could

243
00:09:17,509 --> 00:09:15,360
have evolved

244
00:09:18,870 --> 00:09:17,519
during the evolution of early microbes

245
00:09:21,590 --> 00:09:18,880
where the cell wall

246
00:09:22,630 --> 00:09:21,600
and cell membranes were still evolving

247
00:09:24,550 --> 00:09:22,640
the turbo pressure

248
00:09:26,630 --> 00:09:24,560
in this case is very low compared to the

249
00:09:29,350 --> 00:09:26,640
membranes in the normal cells

250
00:09:31,269 --> 00:09:29,360
which could be mandible by fdaz as it

251
00:09:34,550 --> 00:09:31,279
could be easily mandible

252
00:09:36,150 --> 00:09:34,560
or deformable few vestculation events

253
00:09:38,550 --> 00:09:36,160
could have been observed

254
00:09:39,509 --> 00:09:38,560
in the cells after the addition of the

255
00:09:41,990 --> 00:09:39,519
protein

256
00:09:42,710 --> 00:09:42,000
so we took a dh beta cells having our

257
00:09:45,829 --> 00:09:42,720
constructs

258
00:09:47,190 --> 00:09:45,839
and gave an induction of arabinose and

259
00:09:49,590 --> 00:09:47,200
formed spiroblast

260
00:09:51,350 --> 00:09:49,600
and observed spin and observed pinching

261
00:09:53,590 --> 00:09:51,360
at various degrees

262
00:09:54,870 --> 00:09:53,600
and in various number as given by the

263
00:09:57,190 --> 00:09:54,880

red arrows

264
00:09:58,710 --> 00:09:57,200
this led to the fact that our construct

265
00:10:00,230 --> 00:09:58,720
could lead to the potential division of

266
00:10:03,590 --> 00:10:00,240
spheroblast or the models

267
00:10:08,310 --> 00:10:06,230
the next system we studied is an invitro

268
00:10:09,350 --> 00:10:08,320
one the lipid droplets the droplets were

269
00:10:13,030 --> 00:10:09,360
either made up of

270
00:10:14,550 --> 00:10:13,040
popc pope or only purebc

271
00:10:16,069 --> 00:10:14,560
the protein was allowed to polymerize on

272
00:10:17,910 --> 00:10:16,079
the top of the droplets

273
00:10:19,910 --> 00:10:17,920
the top row shows the images that are

274
00:10:20,790 --> 00:10:19,920
taken in wide field microscopy where the

275
00:10:23,269 --> 00:10:20,800
bottom one

276
00:10:25,190 --> 00:10:23,279
were taken with fits a filter showing

277
00:10:27,030 --> 00:10:25,200
the protein fluorescence

278
00:10:28,550 --> 00:10:27,040
binding of a protein was observed in the

279
00:10:30,949 --> 00:10:28,560
droplets with

280
00:10:32,230 --> 00:10:30,959
the ftse fluorescence coinciding with

281
00:10:34,069 --> 00:10:32,240
the membranes

282
00:10:37,509 --> 00:10:34,079
of the lipid droplets as shown by the

283
00:10:42,069 --> 00:10:40,069
then we did sim microscopy and observed

284
00:10:44,550 --> 00:10:42,079
the z section of the droplets

285
00:10:46,470 --> 00:10:44,560
and saw that the protein is making some

286
00:10:49,350 --> 00:10:46,480
kind of cellular

287
00:10:50,550 --> 00:10:49,360
circular like structure over the

288
00:10:52,870 --> 00:10:50,560

droplets

289
00:10:53,910 --> 00:10:52,880
inside the circles no fluorescence from

290
00:10:56,310 --> 00:10:53,920
fda's is

291
00:10:57,670 --> 00:10:56,320
at all observed this points to the fact

292
00:10:59,430 --> 00:10:57,680
that maybe the protein

293
00:11:01,509 --> 00:10:59,440
might be present on top of the membrane

294
00:11:04,949 --> 00:11:01,519
loosely all over the

295
00:11:06,790 --> 00:11:04,959
lip lipid droplets but in some place

296
00:11:07,990 --> 00:11:06,800
they were able to condense to make

297
00:11:09,829 --> 00:11:08,000
polymers and

298
00:11:11,350 --> 00:11:09,839
could form rings on the droplets which

299
00:11:13,670 --> 00:11:11,360
is a signature move

300
00:11:14,790 --> 00:11:13,680
that fda does before constructing a

301
00:11:17,590 --> 00:11:14,800
bacterial cell

302
00:11:19,509 --> 00:11:17,600
however no plausible constriction was

303
00:11:21,190 --> 00:11:19,519
observed

304
00:11:22,949 --> 00:11:21,200
after observing the proteins on these

305
00:11:25,190 --> 00:11:22,959
two systems we are planning to perform

306
00:11:28,389 --> 00:11:25,200
the experiments on liposomes

307
00:11:31,829 --> 00:11:28,399
and that are made of mixed fatty acids

308
00:11:34,310 --> 00:11:31,839
and see how fds is behaving on them

309
00:11:35,110 --> 00:11:34,320
to see any blebbing of escalation events

310
00:11:37,509 --> 00:11:35,120
that could

311
00:11:39,509 --> 00:11:37,519
be occurring and if it happens then fdac

312
00:11:41,190 --> 00:11:39,519
could stand out as a potential candidate

313
00:11:43,509 --> 00:11:41,200

for being the primitive protein

314
00:11:45,030 --> 00:11:43,519
needed for protocellular division and

315
00:11:48,630 --> 00:11:45,040
the same thing would be observed on

316
00:11:50,150 --> 00:11:48,640
slbs2 to find out about the mechanism

317
00:11:51,990 --> 00:11:50,160
at the end i would like to thank my

318
00:11:54,150 --> 00:11:52,000
funding sources my institute

319
00:11:56,629 --> 00:11:54,160
naiser the university under which my

320
00:11:58,069 --> 00:11:56,639
institute is homi baba and department of

321
00:12:01,590 --> 00:11:58,079
atomic energy

322
00:12:03,509 --> 00:12:01,600
india the project

323
00:12:05,190 --> 00:12:03,519
the the whole work and the ongoing

324
00:12:07,269 --> 00:12:05,200
processes will

325
00:12:08,310 --> 00:12:07,279
be the part of my undergraduate research

326
00:12:10,150 --> 00:12:08,320
project

327
00:12:12,310 --> 00:12:10,160
which is done under dr norman jim

328
00:12:14,069 --> 00:12:12,320
srinivasan and i would also like to

329
00:12:15,990 --> 00:12:14,079
acknowledge one of his

330
00:12:18,069 --> 00:12:16,000
grand student that's ajayakumar sharma

331
00:12:19,670 --> 00:12:18,079
who has helped me in every process

332
00:12:22,069 --> 00:12:19,680
each and every process of the

333
00:12:25,110 --> 00:12:22,079
experiments and also

334
00:12:26,710 --> 00:12:25,120
to the members of srinivasan and matthew

335
00:12:28,790 --> 00:12:26,720
lab

336
00:12:30,790 --> 00:12:28,800
so these are my socials i would be more

337
00:12:31,910 --> 00:12:30,800
than happy to take in any questions

338
00:12:35,590 --> 00:12:31,920

regarding the

339
00:12:38,310 --> 00:12:35,600
work and will be also happy to share

340
00:12:39,910 --> 00:12:38,320
any updates that have been happening