Panelists

Attendees (17)

- Hosts (1)
  - Mike Toillion
- Presenters (3)
  - Andy Burnett
  - Irene Chen
  - Loren Williams
- Participants (13)
  - Aaron Burton
  - Aaron Engelhart
  - Andy
  - Burckhard Seelig
  - David Ross
  - Greg Springsteen
  - James
  - L Norman
  - Lindsay Hays
  - Lucas Mix
  - mallakin
  - MB
  - Ram

Open Chat (Everyone)

Andy Burnett: I am sure they will look forward to seeing everyone's comments ;-)

Andy: Yeah, just different than what I'm used to in terms of creating a document that will eventually be the basis for a RFP? Usually we try to be a bit more general.

---------- (12/04/2013 11:17) ----------

Lindsay Hays: At the end of the webinar, the document that is being discussed here will be opened for comment from the community. The next step will be to combine all of these more specific papers into a single, more general paper.

Lindsay Hays: We are asking individuals to contribute to the part of the roadmap that is closer to their area of study, which may be why this presentation seems less general.

Lucas Mix: I entered late, sorry. Did we go over the document already?

David Ross is typing...

Teleconference Instructions (Parti...

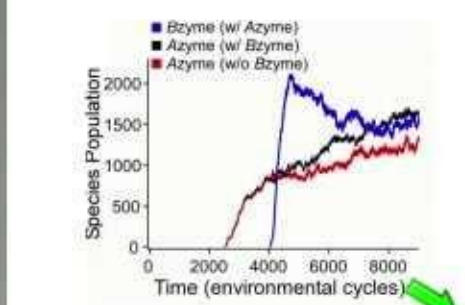
Teleconference Line: 866-692-3582
Passcode: 3649865#
Please use *6 to MUTE your phone's mic when not speaking.
More info: https://astrobiologyfuture.org

Loren Williams & Nick Hud & Irene Chen

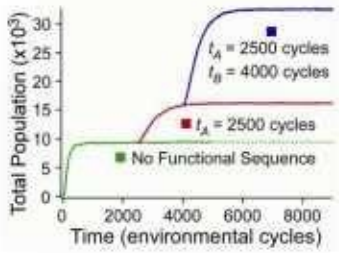
Full Screen

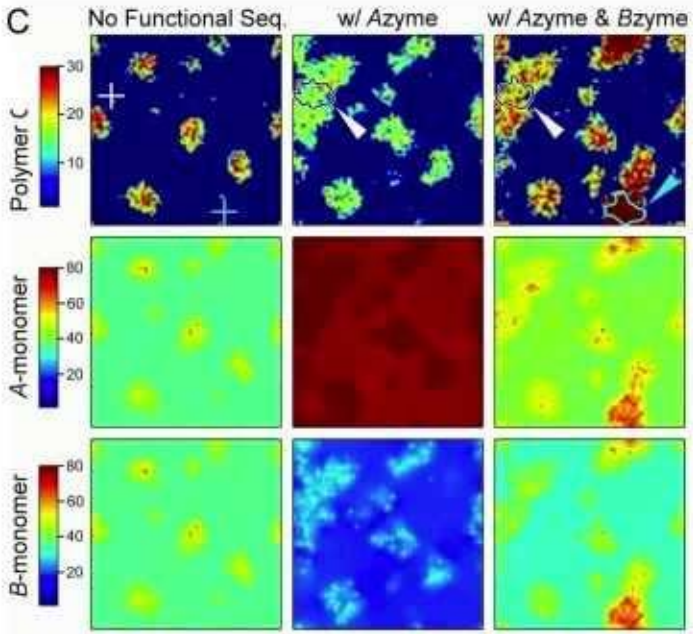
Cooperativity over space and time

Functional species derives more, but not all, of the benefit.



$k_s = 10^{-7}$
$k_r = 10^{-4}$
$k_h = 0.1$
$k_p = 0.01$
$k_m = 1.0$





Walker, Grover, Hud,, *PLoS ONE* 7, e34166, 2012.

1
00:00:12,950 --> 00:00:11,110
welcome to the next in our webinar

2
00:00:16,310 --> 00:00:12,960
series uh this one is how did

3
00:00:18,150 --> 00:00:16,320
macromolecules gain function and uh well

4
00:00:20,310 --> 00:00:18,160
on my notes it was going to be lauren

5
00:00:22,230 --> 00:00:20,320
and irene but we now have a cast of

6
00:00:24,710 --> 00:00:22,240
thousands who might present at any

7
00:00:27,910 --> 00:00:24,720
moment which is uh which is wonderful

8
00:00:32,229 --> 00:00:27,920
um just a couple of admin points to deal

9
00:00:35,430 --> 00:00:32,239
with uh there is a link in the event for

10
00:00:38,069 --> 00:00:35,440
for this webinar to the slides however

11
00:00:40,549 --> 00:00:38,079
because the science is moving forward so

12
00:00:42,790 --> 00:00:40,559
quickly uh these slides are now out of

13
00:00:45,190 --> 00:00:42,800

date but in the next 10 minutes or so an

14
00:00:46,229 --> 00:00:45,200
even newer version of slides will be up

15
00:00:47,270 --> 00:00:46,239
there

16
00:00:49,830 --> 00:00:47,280
um

17
00:00:51,910 --> 00:00:49,840
so uh so just give me a moment and we'll

18
00:00:53,590 --> 00:00:51,920
update that um secondly we had a

19
00:00:55,590 --> 00:00:53,600
question the other day from one of the

20
00:00:58,470 --> 00:00:55,600
participants asking where they could

21
00:01:01,270 --> 00:00:58,480
find the link to the previous uh

22
00:01:04,549 --> 00:01:01,280
recorded webinars so just to clarify

23
00:01:06,789 --> 00:01:04,559
that in the events section if you click

24
00:01:07,750 --> 00:01:06,799
on more events and then go back through

25
00:01:09,830 --> 00:01:07,760
the list

26
00:01:11,590 --> 00:01:09,840
each of the events at the bottom of it

27
00:01:15,109 --> 00:01:11,600
when you click on them should be a link

28
00:01:17,030 --> 00:01:15,119
to the youtube version of that

29
00:01:19,109 --> 00:01:17,040
and then finally the fact that we have

30
00:01:21,670 --> 00:01:19,119
recordings of previous events should be

31
00:01:24,149 --> 00:01:21,680
your clue that this is a recorded event

32
00:01:26,550 --> 00:01:24,159
and everything that you say and type

33
00:01:30,310 --> 00:01:26,560
will be visible on the internet

34
00:01:35,109 --> 00:01:33,590
hi everybody um i'm lauren williams

35
00:01:38,789 --> 00:01:35,119
and uh

36
00:01:40,950 --> 00:01:38,799
sitting on my left here is uh nick hud

37
00:01:43,510 --> 00:01:40,960
uh we're both from georgia tech and then

38
00:01:46,950 --> 00:01:43,520

uh hopefully you can see irene chen who

39
00:01:49,590 --> 00:01:46,960
is at uc santa barbara

40
00:01:52,389 --> 00:01:49,600
and um

41
00:01:55,190 --> 00:01:52,399
basically our task here is

42
00:01:58,149 --> 00:01:55,200
to help develop the

43
00:02:00,069 --> 00:01:58,159
nasa astrobiology roadmap um we're

44
00:02:03,190 --> 00:02:00,079
trying to work out

45
00:02:05,270 --> 00:02:03,200
um a document our part of a document

46
00:02:09,510 --> 00:02:05,280
that will help guide us and other

47
00:02:10,309 --> 00:02:09,520
researchers and nasa into thinking

48
00:02:14,070 --> 00:02:10,319
uh

49
00:02:15,990 --> 00:02:14,080
intelligently and funding intelligently

50
00:02:17,510 --> 00:02:16,000
science related to the

51
00:02:19,430 --> 00:02:17,520
origin of life

52
00:02:22,150 --> 00:02:19,440
so our

53
00:02:25,030 --> 00:02:22,160
small task here is to think about how

54
00:02:27,510 --> 00:02:25,040
did macromolecules gain function

55
00:02:30,390 --> 00:02:27,520
and what i've started here with here is

56
00:02:32,470 --> 00:02:30,400
just a picture of the ribosome which is

57
00:02:34,550 --> 00:02:32,480
a functional assembly and also thought

58
00:02:37,589 --> 00:02:34,560
to be one of the oldest assemblies in

59
00:02:39,270 --> 00:02:37,599
biology so in a really basic way we

60
00:02:40,550 --> 00:02:39,280
could say where did this come from how

61
00:02:41,509 --> 00:02:40,560
did these

62
00:02:42,710 --> 00:02:41,519
large

63
00:02:43,830 --> 00:02:42,720

polymers

64
00:02:45,830 --> 00:02:43,840
um

65
00:02:48,229 --> 00:02:45,840
where do they come from and how they how

66
00:02:49,670 --> 00:02:48,239
do they become functional and i thought

67
00:02:50,710 --> 00:02:49,680
it might be

68
00:02:52,390 --> 00:02:50,720
good

69
00:02:55,350 --> 00:02:52,400
probably because i'm just a reductionist

70
00:02:56,869 --> 00:02:55,360
by nature is to to start thinking

71
00:02:59,190 --> 00:02:56,879
really carefully about what we mean by

72
00:03:00,070 --> 00:02:59,200
function what does it mean um

73
00:03:03,589 --> 00:03:00,080
to

74
00:03:05,350 --> 00:03:03,599
actually before i i get very far i want

75
00:03:07,430 --> 00:03:05,360
to talk about tomorrow's

76
00:03:08,790 --> 00:03:07,440
webinar there's a there's a hopefully

77
00:03:11,270 --> 00:03:08,800
most of you know about this already but

78
00:03:13,190 --> 00:03:11,280
there is a webinar tomorrow um which is

79
00:03:15,589 --> 00:03:13,200
very closely related in fact it's almost

80
00:03:16,869 --> 00:03:15,599
integrated with the one we have today

81
00:03:19,990 --> 00:03:16,879
um which is

82
00:03:22,149 --> 00:03:20,000
being conducted by uh julian burkhart

83
00:03:23,589 --> 00:03:22,159
and um it's gonna be the same time same

84
00:03:25,830 --> 00:03:23,599
place and that was

85
00:03:27,509 --> 00:03:25,840
where how did peptide meet nucleotide

86
00:03:29,270 --> 00:03:27,519
which is

87
00:03:32,229 --> 00:03:29,280
similar if you think about it too how

88
00:03:34,470 --> 00:03:32,239

did macromolecules gain function

89
00:03:36,229 --> 00:03:34,480
um it's closely related so hopefully

90
00:03:38,550 --> 00:03:36,239
those of you here can

91
00:03:39,830 --> 00:03:38,560
also make it to that seminar or that

92
00:03:41,830 --> 00:03:39,840
webinar too

93
00:03:43,110 --> 00:03:41,840
okay so what i want to do is talk a

94
00:03:45,430 --> 00:03:43,120
little bit about function i mean i'm

95
00:03:47,190 --> 00:03:45,440
going to talk about function

96
00:03:49,990 --> 00:03:47,200
how i would like to think about function

97
00:03:51,670 --> 00:03:50,000
and then actually nick is going to talk

98
00:03:53,110 --> 00:03:51,680
about what he thinks about function that

99
00:03:54,149 --> 00:03:53,120
irene is going to talk about a little

100
00:03:56,229 --> 00:03:54,159
bit about

101
00:03:57,910 --> 00:03:56,239
so what we're going to really do is

102
00:04:00,710 --> 00:03:57,920
start by saying what do we mean by

103
00:04:02,630 --> 00:04:00,720
function when we say when we ask how

104
00:04:04,630 --> 00:04:02,640
uh macromolecules

105
00:04:08,789 --> 00:04:04,640
achieve function

106
00:04:10,309 --> 00:04:08,799
and um so this is the list of us

107
00:04:12,630 --> 00:04:10,319
some of us who have been working on this

108
00:04:14,229 --> 00:04:12,640
document

109
00:04:16,310 --> 00:04:14,239
i probably need to add more people to

110
00:04:17,270 --> 00:04:16,320
this and of course everyone's welcome we

111
00:04:19,349 --> 00:04:17,280
want

112
00:04:21,749 --> 00:04:19,359
the more people we have contribute to

113
00:04:24,070 --> 00:04:21,759

this effort the better it will be so if

114
00:04:26,629 --> 00:04:24,080
you haven't actually actively started

115
00:04:30,150 --> 00:04:26,639
uh working with us on this you know and

116
00:04:32,790 --> 00:04:30,160
you're interested please please join us

117
00:04:33,990 --> 00:04:32,800
um okay so i want to talk about function

118
00:04:37,590 --> 00:04:34,000
from

119
00:04:42,629 --> 00:04:37,600
trypsin

120
00:04:43,990 --> 00:04:42,639
function it catalyzes a chemical

121
00:04:45,670 --> 00:04:44,000
transformation

122
00:04:46,629 --> 00:04:45,680
and so when we talk about trypsin having

123
00:04:48,310 --> 00:04:46,639
function

124
00:04:50,310 --> 00:04:48,320
we say number one it folds into

125
00:04:52,469 --> 00:04:50,320
three-dimensional structure so that

126
00:04:54,469 --> 00:04:52,479
that's part of trypsin function it binds

127
00:04:56,550 --> 00:04:54,479
to a specific substrate

128
00:04:59,909 --> 00:04:56,560
it stabilizes transition states and

129
00:05:02,790 --> 00:04:59,919
intermediates and it is regulated so i

130
00:05:05,830 --> 00:05:02,800
think in modern biology we can kind of

131
00:05:06,790 --> 00:05:05,840
probably agree we know what function is

132
00:05:09,029 --> 00:05:06,800
um

133
00:05:10,230 --> 00:05:09,039
it has to do

134
00:05:12,310 --> 00:05:10,240
either either if we're talking about

135
00:05:15,510 --> 00:05:12,320
proteins it has to do with you know

136
00:05:18,070 --> 00:05:15,520
catalysis and and folding and

137
00:05:19,990 --> 00:05:18,080
and that activity or if we're talking

138
00:05:21,990 --> 00:05:20,000

about genes it has to do with sequences

139
00:05:23,830 --> 00:05:22,000
that contain information

140
00:05:25,749 --> 00:05:23,840
so so i think it's pretty easy when we

141
00:05:28,310 --> 00:05:25,759
look at modern biology for us to think

142
00:05:30,230 --> 00:05:28,320
about function but when we think about

143
00:05:32,710 --> 00:05:30,240
ancient biology or even

144
00:05:35,749 --> 00:05:32,720
maybe before biology you know

145
00:05:37,590 --> 00:05:35,759
about process what does function mean

146
00:05:39,990 --> 00:05:37,600
when we're talking about

147
00:05:42,629 --> 00:05:40,000
abiotic systems or early

148
00:05:44,150 --> 00:05:42,639
biotic systems and so

149
00:05:46,629 --> 00:05:44,160
um

150
00:05:50,230 --> 00:05:46,639
if we think about that in terms of

151
00:05:52,469 --> 00:05:50,240
trypsin we can break that down to say

152
00:05:54,629 --> 00:05:52,479
what is three-dimensional structure and

153
00:05:56,070 --> 00:05:54,639
that that's basically self-assembly i

154
00:05:57,430 --> 00:05:56,080
mean trypsin achieves its

155
00:05:59,749 --> 00:05:57,440
three-dimensional structure by

156
00:06:01,830 --> 00:05:59,759
self-assembly and then it binds to

157
00:06:04,469 --> 00:06:01,840
specific substrates by

158
00:06:06,309 --> 00:06:04,479
assembly between protein and substrate

159
00:06:08,550 --> 00:06:06,319
it stabilizes transition states and

160
00:06:10,150 --> 00:06:08,560
intermediates and that has to do with

161
00:06:12,150 --> 00:06:10,160
assembly between the protein and

162
00:06:14,390 --> 00:06:12,160
transition states and intermediates and

163
00:06:15,510 --> 00:06:14,400

then its regulation also has to do with

164
00:06:18,710 --> 00:06:15,520
assembly

165
00:06:21,189 --> 00:06:18,720
so i think my thought

166
00:06:24,469 --> 00:06:21,199
is um people are having a hard time

167
00:06:25,590 --> 00:06:24,479
logging on i'm seeing that

168
00:06:30,550 --> 00:06:25,600
anyway i guess somebody's working on

169
00:06:34,230 --> 00:06:32,150
i'm ironing

170
00:06:35,990 --> 00:06:34,240
so okay i'll just proceed with this so

171
00:06:38,390 --> 00:06:36,000
anyway when i when i think about

172
00:06:39,510 --> 00:06:38,400
function on a really detailed molecular

173
00:06:40,230 --> 00:06:39,520
level

174
00:06:42,550 --> 00:06:40,240
uh

175
00:06:45,110 --> 00:06:42,560
as a reductionist i guess um i'm

176
00:06:46,550 --> 00:06:45,120
thinking about assembly molecules

177
00:06:49,350 --> 00:06:46,560
um with

178
00:06:53,189 --> 00:06:49,360
complementary arrays of

179
00:06:54,150 --> 00:06:53,199
molecular interactions as in dna

180
00:06:56,629 --> 00:06:54,160
um

181
00:06:58,950 --> 00:06:56,639
base pairing or in protein

182
00:07:00,469 --> 00:06:58,960
beta sheet assembly

183
00:07:04,230 --> 00:07:00,479
you know those kind of

184
00:07:06,710 --> 00:07:04,240
really beautiful arrays of complementary

185
00:07:09,830 --> 00:07:06,720
functional groups that can interact

186
00:07:13,670 --> 00:07:09,840
so in one sense we can define biology

187
00:07:15,909 --> 00:07:13,680
as an extremely elaborate

188
00:07:19,189 --> 00:07:15,919

system of assembly and assembly so when

189
00:07:20,870 --> 00:07:19,199
you hard boil an egg basically

190
00:07:22,629 --> 00:07:20,880
you're just you're just destroying all

191
00:07:24,790 --> 00:07:22,639
of that assembly that's why you can

192
00:07:26,790 --> 00:07:24,800
never unboil the egg and that's why it

193
00:07:28,469 --> 00:07:26,800
turns white basically it all has to do

194
00:07:29,350 --> 00:07:28,479
with assembly

195
00:07:31,589 --> 00:07:29,360
so

196
00:07:33,350 --> 00:07:31,599
now i want to just project that back

197
00:07:35,270 --> 00:07:33,360
and think about

198
00:07:36,150 --> 00:07:35,280
an abiotic system so we could think

199
00:07:39,749 --> 00:07:36,160
about

200
00:07:42,070 --> 00:07:39,759
the ancient earth we could just some

201
00:07:44,309 --> 00:07:42,080
abiotic system i think most of us here

202
00:07:45,270 --> 00:07:44,319
will agree that

203
00:07:47,589 --> 00:07:45,280
uh

204
00:07:49,350 --> 00:07:47,599
abiotic systems can generate organic

205
00:07:51,749 --> 00:07:49,360
molecules small organic molecules

206
00:07:53,110 --> 00:07:51,759
there's just a lot of evidence that that

207
00:07:55,909 --> 00:07:53,120
can happen

208
00:07:57,430 --> 00:07:55,919
and so this is my schematic of a

209
00:07:58,390 --> 00:07:57,440
collection of organic molecules i only

210
00:08:00,869 --> 00:07:58,400
have two

211
00:08:02,309 --> 00:08:00,879
but it could be more it could be one

212
00:08:06,950 --> 00:08:02,319
it's not really that important it's we

213
00:08:09,749 --> 00:08:06,960

have some totally abiotic system that

214
00:08:12,150 --> 00:08:09,759
that generates uh small molecules and

215
00:08:13,430 --> 00:08:12,160
those small molecules can self-assemble

216
00:08:15,270 --> 00:08:13,440
some of them

217
00:08:16,950 --> 00:08:15,280
or maybe they it's not self-assembly

218
00:08:18,230 --> 00:08:16,960
maybe it's assembly between molecules

219
00:08:19,749 --> 00:08:18,240
but anyway

220
00:08:23,749 --> 00:08:19,759
uh

221
00:08:26,629 --> 00:08:23,759
i think it's it's clear that um

222
00:08:28,390 --> 00:08:26,639
that

223
00:08:30,150 --> 00:08:28,400
organic molecules can be generated in

224
00:08:31,670 --> 00:08:30,160
abiotic systems and

225
00:08:34,790 --> 00:08:31,680
and some of those molecules are

226
00:08:36,310 --> 00:08:34,800
certainly capable of

227
00:08:39,829 --> 00:08:36,320
and

228
00:08:41,269 --> 00:08:39,839
the interesting thing is that assembled

229
00:08:43,269 --> 00:08:41,279
have different properties than

230
00:08:45,269 --> 00:08:43,279
unassembled molecules we know that

231
00:08:47,110 --> 00:08:45,279
they're basically more stable to

232
00:08:48,550 --> 00:08:47,120
chemical degradation enzymatic

233
00:08:50,949 --> 00:08:48,560
degradation

234
00:08:52,470 --> 00:08:50,959
irradiation basically once a molecule is

235
00:08:55,190 --> 00:08:52,480
assembled

236
00:08:56,790 --> 00:08:55,200
it lives longer than a than a molecule

237
00:08:58,550 --> 00:08:56,800
that is not assembled

238
00:09:00,470 --> 00:08:58,560

and so i would

239
00:09:02,870 --> 00:09:00,480
i would suggest that this is kind of the

240
00:09:04,150 --> 00:09:02,880
kickstart of evolution you could have a

241
00:09:06,070 --> 00:09:04,160
system where you really don't have

242
00:09:09,590 --> 00:09:06,080
catalysis you don't have polymers you

243
00:09:11,030 --> 00:09:09,600
don't have darwinian evolution but you

244
00:09:13,110 --> 00:09:11,040
you would have

245
00:09:15,509 --> 00:09:13,120
you could easily have self-assembling

246
00:09:18,070 --> 00:09:15,519
molecules and then the populations of

247
00:09:21,030 --> 00:09:18,080
molecules are going to be shifted

248
00:09:24,310 --> 00:09:21,040
depending on the assembly process

249
00:09:25,829 --> 00:09:24,320
and so uh to me this is this is sort of

250
00:09:28,550 --> 00:09:25,839
i would say would be the kickstart of

251
00:09:31,269 --> 00:09:28,560
evolution is that assembly can come very

252
00:09:32,630 --> 00:09:31,279
early and it's not all that hard to get

253
00:09:34,070 --> 00:09:32,640
um and

254
00:09:36,150 --> 00:09:34,080
i think if we

255
00:09:38,150 --> 00:09:36,160
and this is not just an esoteric

256
00:09:40,230 --> 00:09:38,160
unanswerable question we could look at

257
00:09:41,269 --> 00:09:40,240
titan for example and my prediction

258
00:09:42,230 --> 00:09:41,279
would be

259
00:09:44,230 --> 00:09:42,240
that

260
00:09:45,829 --> 00:09:44,240
evolution has already kick-started on

261
00:09:49,190 --> 00:09:45,839
titan we know we have rich organic

262
00:09:51,269 --> 00:09:49,200
chemistry we even have polymers on titan

263
00:09:53,269 --> 00:09:51,279

and uh

264
00:09:54,790 --> 00:09:53,279
ultimately when we can

265
00:09:56,230 --> 00:09:54,800
when we can find out a lot about titan

266
00:09:57,269 --> 00:09:56,240
nasa has to

267
00:09:59,590 --> 00:09:57,279
to uh

268
00:10:01,350 --> 00:09:59,600
to to do the assays to get the

269
00:10:03,509 --> 00:10:01,360
instrumentation there but the prediction

270
00:10:06,389 --> 00:10:03,519
would be that there are self-assembling

271
00:10:08,630 --> 00:10:06,399
molecules on titan and that the the

272
00:10:10,470 --> 00:10:08,640
molecular populations are preserved are

273
00:10:12,070 --> 00:10:10,480
perturbed by that assembly basically

274
00:10:14,949 --> 00:10:12,080
that that's

275
00:10:16,949 --> 00:10:14,959
that there's an enrichment of um

276
00:10:18,710 --> 00:10:16,959
assembly molecules on titan there's

277
00:10:21,030 --> 00:10:18,720
there's dunes of

278
00:10:23,670 --> 00:10:21,040
organic material on titan and there's

279
00:10:25,430 --> 00:10:23,680
these lakes are saturated with probably

280
00:10:28,389 --> 00:10:25,440
with these hydrocarbon lakes are

281
00:10:29,670 --> 00:10:28,399
saturated and we have uh photochemistry

282
00:10:31,509 --> 00:10:29,680
so we have we have synthesis and

283
00:10:33,509 --> 00:10:31,519
degradation we have all of that going on

284
00:10:34,550 --> 00:10:33,519
so this this would be a really i think

285
00:10:37,110 --> 00:10:34,560
uh

286
00:10:39,110 --> 00:10:37,120
an excellent sort of abiotic system to

287
00:10:41,110 --> 00:10:39,120
basically say is

288
00:10:43,190 --> 00:10:41,120

not not to suggest maybe that we have

289
00:10:43,990 --> 00:10:43,200
darwinian evolution going on there but

290
00:10:47,829 --> 00:10:44,000
uh

291
00:10:55,910 --> 00:10:47,839
of

292
00:10:58,630 --> 00:10:55,920
molecules

293
00:11:00,630 --> 00:10:58,640
so that's it that's a minimalist

294
00:11:02,710 --> 00:11:00,640
and uh if anybody has any comments

295
00:11:04,230 --> 00:11:02,720
that's a minimalist uh

296
00:11:06,069 --> 00:11:04,240
just

297
00:11:07,750 --> 00:11:06,079
is it possible to butt in here i wasn't

298
00:11:09,990 --> 00:11:07,760
sure if uh

299
00:11:12,389 --> 00:11:10,000
yeah that's what we're after

300
00:11:13,190 --> 00:11:12,399
okay yeah james lines uh asu

301
00:11:17,190 --> 00:11:13,200
uh

302
00:11:19,750 --> 00:11:17,200
just your your titan analogy most mostly

303
00:11:21,509 --> 00:11:19,760
what you're doing on titan is creating

304
00:11:23,269 --> 00:11:21,519
aerosols

305
00:11:24,790 --> 00:11:23,279
you know particulates in the atmosphere

306
00:11:27,430 --> 00:11:24,800
and those are settling under the surface

307
00:11:30,389 --> 00:11:27,440
so your chemistry is really going to be

308
00:11:32,790 --> 00:11:30,399
i think dictated a lot by those particle

309
00:11:35,269 --> 00:11:32,800
surfaces

310
00:11:39,829 --> 00:11:35,279
well yes that's what i did right surface

311
00:11:45,670 --> 00:11:43,030
or in the atmosphere of titan so

312
00:11:50,069 --> 00:11:45,680
yeah i mean my understanding from i was

313
00:11:51,590 --> 00:11:50,079

just out at the icy worlds group uh at

314
00:11:53,430 --> 00:11:51,600
um

315
00:11:56,389 --> 00:11:53,440
jpl and they were

316
00:11:59,030 --> 00:11:56,399
you know looking at saturated solutions

317
00:11:59,829 --> 00:11:59,040
of hydrocarbons mimicking these lakes

318
00:12:01,750 --> 00:11:59,839
and

319
00:12:03,430 --> 00:12:01,760
at least the information i had from them

320
00:12:04,949 --> 00:12:03,440
that

321
00:12:06,230 --> 00:12:04,959
there were

322
00:12:08,870 --> 00:12:06,240
probably

323
00:12:10,870 --> 00:12:08,880
high concentrations of

324
00:12:11,750 --> 00:12:10,880
organics of some kind exactly i don't

325
00:12:13,509 --> 00:12:11,760
think

326
00:12:15,030 --> 00:12:13,519
um in the lake

327
00:12:17,269 --> 00:12:15,040
so

328
00:12:19,350 --> 00:12:17,279
um

329
00:12:21,030 --> 00:12:19,360
that was sort of my basis for saying

330
00:12:22,949 --> 00:12:21,040
that

331
00:12:25,190 --> 00:12:22,959
okay

332
00:12:26,550 --> 00:12:25,200
but we can talk about that

333
00:12:27,670 --> 00:12:26,560
all right so anyway that's kind of a

334
00:12:28,949 --> 00:12:27,680
minimal

335
00:12:30,550 --> 00:12:28,959
you want to see if there's any questions

336
00:12:32,150 --> 00:12:30,560
for you yeah are there questions on that

337
00:12:33,829 --> 00:12:32,160
um because we're gonna have change and

338
00:12:35,590 --> 00:12:33,839

nick is gonna talk a little bit about

339
00:12:37,110 --> 00:12:35,600
sort of a higher level definition of

340
00:12:39,670 --> 00:12:37,120
assembly

341
00:12:43,670 --> 00:12:39,680
um

342
00:12:46,310 --> 00:12:44,790
okay

343
00:12:48,949 --> 00:12:46,320
i'm saying

344
00:12:51,750 --> 00:12:50,069
okay so

345
00:12:53,670 --> 00:12:51,760
lauren asked you know how would i

346
00:12:55,590 --> 00:12:53,680
address this question about this

347
00:12:56,710 --> 00:12:55,600
emergence of function

348
00:12:58,389 --> 00:12:56,720
and

349
00:13:00,949 --> 00:12:58,399
i i've been thinking about this a while

350
00:13:03,910 --> 00:13:00,959
and and with sarah walker i was a

351
00:13:06,470 --> 00:13:03,920
postdoc with us for a year you might

352
00:13:08,710 --> 00:13:06,480
know her we we worked on a simulation

353
00:13:09,670 --> 00:13:08,720
and i'm just gonna go through

354
00:13:12,150 --> 00:13:09,680
um

355
00:13:14,470 --> 00:13:12,160
just a few slices show you what we're

356
00:13:15,750 --> 00:13:14,480
thinking but it's more of a backdrop of

357
00:13:17,990 --> 00:13:15,760
what i think are some of the big

358
00:13:22,069 --> 00:13:18,000
questions here and and i start off with

359
00:13:23,990 --> 00:13:22,079
this slide um which is uh showing

360
00:13:27,110 --> 00:13:24,000
that uh you know

361
00:13:30,470 --> 00:13:27,120
we're expecting that we have polymers

362
00:13:32,629 --> 00:13:30,480
and monomers and that these go together

363
00:13:34,550 --> 00:13:32,639

uh to either make more polymers or

364
00:13:36,310 --> 00:13:34,560
somehow they're templating to replicate

365
00:13:37,509 --> 00:13:36,320
themselves and i think that this

366
00:13:39,430 --> 00:13:37,519
captures

367
00:13:41,030 --> 00:13:39,440
the type of system that lauren is

368
00:13:43,430 --> 00:13:41,040
talking about you know when he talks

369
00:13:45,750 --> 00:13:43,440
about functional systems lauren's saying

370
00:13:47,509 --> 00:13:45,760
the minimal functional system you have

371
00:13:48,949 --> 00:13:47,519
is that you have to have recognition you

372
00:13:49,990 --> 00:13:48,959
have to have assembly you have to have

373
00:13:52,389 --> 00:13:50,000
folding

374
00:13:54,790 --> 00:13:52,399
and i i agree with him about that but

375
00:13:56,230 --> 00:13:54,800
what i also countered to him was that i

376
00:13:57,590 --> 00:13:56,240
think that when a lot of people think

377
00:13:59,430 --> 00:13:57,600
about function

378
00:14:01,829 --> 00:13:59,440
they think about the emergence of

379
00:14:03,910 --> 00:14:01,839
sequences that can do something right

380
00:14:07,590 --> 00:14:03,920
beyond just what the polymer you know

381
00:14:09,269 --> 00:14:07,600
intrinsically does like you know form a

382
00:14:11,189 --> 00:14:09,279
stable structure

383
00:14:12,470 --> 00:14:11,199
and so i think when we think of a

384
00:14:15,110 --> 00:14:12,480
function

385
00:14:19,350 --> 00:14:15,120
we have to come up with models for for

386
00:14:20,310 --> 00:14:19,360
how do we say generate molecules um with

387
00:14:21,350 --> 00:14:20,320
or

388
00:14:23,670 --> 00:14:21,360

how do we

389
00:14:25,590 --> 00:14:23,680
favor molecules that have sequences that

390
00:14:26,629 --> 00:14:25,600
can catalyze reaction

391
00:14:29,350 --> 00:14:26,639
and so

392
00:14:32,790 --> 00:14:29,360
what we did was we looked at a model

393
00:14:35,910 --> 00:14:32,800
where we have polymers down on a surface

394
00:14:37,670 --> 00:14:35,920
in a 2d and they diffuse around

395
00:14:38,870 --> 00:14:37,680
and then we have monomers that can move

396
00:14:40,949 --> 00:14:38,880
around too

397
00:14:43,030 --> 00:14:40,959
and they're polymerizing

398
00:14:44,870 --> 00:14:43,040
go to the next slide

399
00:14:46,790 --> 00:14:44,880
and just you know show you some of the

400
00:14:50,710 --> 00:14:46,800
things that we see come out of these

401
00:14:52,790 --> 00:14:50,720
that i think uh give us an idea about

402
00:14:54,710 --> 00:14:52,800
what is possible and also what we're

403
00:14:56,629 --> 00:14:54,720
going for

404
00:14:59,509 --> 00:14:56,639
if you have a system of monomers that

405
00:15:02,069 --> 00:14:59,519
can spontaneously polymerize and

406
00:15:03,590 --> 00:15:02,079
replicate

407
00:15:06,230 --> 00:15:03,600
then what you're going to do is very

408
00:15:08,710 --> 00:15:06,240
quickly you run out of resources and you

409
00:15:11,670 --> 00:15:08,720
reach a steady state level of the number

410
00:15:12,870 --> 00:15:11,680
of polymers that can be supported by the

411
00:15:14,230 --> 00:15:12,880
system

412
00:15:16,310 --> 00:15:14,240
and then it becomes limiting in the

413
00:15:18,870 --> 00:15:16,320

number of monomers that you have

414
00:15:21,990 --> 00:15:18,880
and if you consider that there could be

415
00:15:24,230 --> 00:15:22,000
lots of sequences out there

416
00:15:26,310 --> 00:15:24,240
then

417
00:15:28,389 --> 00:15:26,320
but none of them are functional to start

418
00:15:31,829 --> 00:15:28,399
with then nobody has a selective

419
00:15:35,269 --> 00:15:31,839
advantage and sequences stochastically

420
00:15:37,269 --> 00:15:35,279
can come and die off and live on and

421
00:15:39,670 --> 00:15:37,279
some will build up and if you look at

422
00:15:41,189 --> 00:15:39,680
this down here on the two-dimensional

423
00:15:43,350 --> 00:15:41,199
grid here

424
00:15:45,590 --> 00:15:43,360
because we have limited diffusion what

425
00:15:48,949 --> 00:15:45,600
happens is that you get colonies of

426
00:15:51,990 --> 00:15:48,959
polymers that are building up and over

427
00:15:55,749 --> 00:15:52,000
the number of cycles now there's no

428
00:15:57,910 --> 00:15:55,759
functionality in these beyond what

429
00:15:59,749 --> 00:15:57,920
lauren had said lauren had said that

430
00:16:02,470 --> 00:15:59,759
monomers that can recognize each other

431
00:16:03,749 --> 00:16:02,480
come together so that that is implied in

432
00:16:05,430 --> 00:16:03,759
this that we have that level of

433
00:16:07,189 --> 00:16:05,440
functionality

434
00:16:10,629 --> 00:16:07,199
but what then we did

435
00:16:13,670 --> 00:16:10,639
was we said what if a sequence comes

436
00:16:16,230 --> 00:16:13,680
along and we call this an enzyme and the

437
00:16:18,710 --> 00:16:16,240
idea is that there are monomers that are

438
00:16:21,189 --> 00:16:18,720

a and b that pair together and the idea

439
00:16:24,629 --> 00:16:21,199
is that if you have this polymer that

440
00:16:25,990 --> 00:16:24,639
can generate a monomer that's in short

441
00:16:28,629 --> 00:16:26,000
supply

442
00:16:30,710 --> 00:16:28,639
we said in a system like this

443
00:16:32,550 --> 00:16:30,720
does that polymer have a selective

444
00:16:35,350 --> 00:16:32,560
advantage and the answer is absolutely

445
00:16:37,350 --> 00:16:35,360
yes over a wide range of parameters

446
00:16:38,230 --> 00:16:37,360
which i i won't go into but these have

447
00:16:41,269 --> 00:16:38,240
to do

448
00:16:43,430 --> 00:16:41,279
um with the lifetime of these polymers

449
00:16:45,509 --> 00:16:43,440
in in the system

450
00:16:47,990 --> 00:16:45,519
and the the rate at which they the

451
00:16:49,590 --> 00:16:48,000
monomers move around if using that what

452
00:16:52,710 --> 00:16:49,600
we're seeing is that

453
00:16:56,389 --> 00:16:52,720
a polymer that has a function

454
00:16:58,790 --> 00:16:56,399
has a much longer average lifetime

455
00:16:59,590 --> 00:16:58,800
than just random sequences in the mix

456
00:17:01,350 --> 00:16:59,600
even though these aren't

457
00:17:02,949 --> 00:17:01,360
compartmentalized there's just limited

458
00:17:03,670 --> 00:17:02,959
diffusion

459
00:17:07,029 --> 00:17:03,680
and

460
00:17:08,549 --> 00:17:07,039
the population the number of polymers uh

461
00:17:11,189 --> 00:17:08,559
that that

462
00:17:13,750 --> 00:17:11,199
um our steady state that have a function

463
00:17:15,350 --> 00:17:13,760

versus those that don't is also much

464
00:17:17,350 --> 00:17:15,360
higher on average

465
00:17:19,350 --> 00:17:17,360
and so you know just to look at this in

466
00:17:21,110 --> 00:17:19,360
a in a spatial map

467
00:17:23,909 --> 00:17:21,120
what you see is that

468
00:17:27,510 --> 00:17:23,919
what we what we have here is

469
00:17:30,789 --> 00:17:29,029
we have a

470
00:17:33,029 --> 00:17:30,799
on the green line here is this if you

471
00:17:34,870 --> 00:17:33,039
have no functional sequence you you go

472
00:17:36,230 --> 00:17:34,880
up and you reach a steady state level

473
00:17:37,990 --> 00:17:36,240
and then forever you have the same

474
00:17:41,029 --> 00:17:38,000
number of polymers

475
00:17:42,950 --> 00:17:41,039
um if at this point right here along

476
00:17:44,789 --> 00:17:42,960
comes a functional polymer that can

477
00:17:48,710 --> 00:17:44,799
generate a monomer in short in short

478
00:17:51,029 --> 00:17:48,720
supply then the whole population overall

479
00:17:53,350 --> 00:17:51,039
benefits from that until the other

480
00:17:55,830 --> 00:17:53,360
monomer is in short supply and then you

481
00:17:57,669 --> 00:17:55,840
can do a scenario where a sequence comes

482
00:18:00,710 --> 00:17:57,679
along where the other monomer that's in

483
00:18:02,789 --> 00:18:00,720
short supply is catalyzed by some

484
00:18:05,430 --> 00:18:02,799
functional polymer and then everybody

485
00:18:08,070 --> 00:18:05,440
builds up in their populations so the

486
00:18:10,230 --> 00:18:08,080
reason that i i bring this up is that i

487
00:18:11,750 --> 00:18:10,240
i think that

488
00:18:14,630 --> 00:18:11,760

what we need to

489
00:18:19,029 --> 00:18:17,830
in looking at functionality emerging in

490
00:18:22,470 --> 00:18:19,039
polymers

491
00:18:23,990 --> 00:18:22,480
is a very wide range of functions have

492
00:18:26,070 --> 00:18:24,000
to

493
00:18:28,870 --> 00:18:26,080
get their foothold

494
00:18:31,430 --> 00:18:28,880
in order for life to really come about

495
00:18:32,870 --> 00:18:31,440
but what lauren's talking about is fine

496
00:18:35,110 --> 00:18:32,880
with respect to

497
00:18:37,590 --> 00:18:35,120
what are the basic building blocks that

498
00:18:39,909 --> 00:18:37,600
you need um

499
00:18:41,590 --> 00:18:39,919
you know you you need building blocks

500
00:18:44,390 --> 00:18:41,600
that can recognize each other packed

501
00:18:46,870 --> 00:18:44,400
together well that can form a backbone

502
00:18:49,350 --> 00:18:46,880
that can fold and that and so we right

503
00:18:51,990 --> 00:18:49,360
away if we think peptides fit the bill

504
00:18:54,789 --> 00:18:52,000
nucleic acids fit the bill that's great

505
00:18:57,510 --> 00:18:54,799
but but then we have to select sequence

506
00:18:59,430 --> 00:18:57,520
from there and we have to select a lot

507
00:19:00,630 --> 00:18:59,440
of sequences you know what i think is

508
00:19:02,230 --> 00:19:00,640
that we have to

509
00:19:05,350 --> 00:19:02,240
have

510
00:19:06,710 --> 00:19:05,360
life before we even get to say cellular

511
00:19:08,630 --> 00:19:06,720
life it depends on your model of when

512
00:19:10,549 --> 00:19:08,640
you want compartmentalization

513
00:19:13,750 --> 00:19:10,559

but before you have something at the

514
00:19:15,190 --> 00:19:13,760
level say of the ribosome i think still

515
00:19:17,430 --> 00:19:15,200
there would have been a lot of enzymes

516
00:19:19,830 --> 00:19:17,440
that came first that were

517
00:19:20,950 --> 00:19:19,840
selected out of um

518
00:19:23,990 --> 00:19:20,960
of

519
00:19:24,710 --> 00:19:24,000
maybe non-templated polymers right ones

520
00:19:28,390 --> 00:19:24,720
that

521
00:19:30,310 --> 00:19:28,400
folded and were stable but still were um

522
00:19:32,870 --> 00:19:30,320
doing something that was good for them

523
00:19:36,310 --> 00:19:32,880
or their environment and so you know

524
00:19:38,310 --> 00:19:36,320
what what i see is a need is to

525
00:19:40,230 --> 00:19:38,320
especially experimentally demonstrate

526
00:19:42,150 --> 00:19:40,240
that this is the case i think you know

527
00:19:44,310 --> 00:19:42,160
there's a lot of focus that's been on

528
00:19:45,590 --> 00:19:44,320
getting a replicator and that and that's

529
00:19:47,830 --> 00:19:45,600
good but

530
00:19:51,270 --> 00:19:47,840
we need to be thinking about

531
00:19:53,110 --> 00:19:51,280
the systems that would allow

532
00:19:55,510 --> 00:19:53,120
many different functions to take

533
00:19:56,390 --> 00:19:55,520
foothold uh take hold in the soup and

534
00:20:01,990 --> 00:19:56,400
this is

535
00:20:04,789 --> 00:20:02,000
from the top down work uh of carl woes

536
00:20:06,870 --> 00:20:04,799
and what woe says is that you know when

537
00:20:07,669 --> 00:20:06,880
he looks back at the evolution of the

538
00:20:09,830 --> 00:20:07,679

cell

539
00:20:11,430 --> 00:20:09,840
based upon his genetic analysis he comes

540
00:20:13,150 --> 00:20:11,440
with a conclusion

541
00:20:15,990 --> 00:20:13,160
that there must have been many

542
00:20:17,590 --> 00:20:16,000
cooperating polymers because there were

543
00:20:19,750 --> 00:20:17,600
so many problems that needed to be

544
00:20:21,669 --> 00:20:19,760
solved and so you know in my mind when

545
00:20:24,150 --> 00:20:21,679
we're looking at function coming out of

546
00:20:25,909 --> 00:20:24,160
these polymers we have to in the

547
00:20:28,710 --> 00:20:25,919
earliest stages of life we have to look

548
00:20:32,230 --> 00:20:28,720
for a system that would allow

549
00:20:36,390 --> 00:20:32,240
right the coexistence the

550
00:20:39,029 --> 00:20:36,400
non-selfish say cooperation uh of many

551
00:20:43,110 --> 00:20:39,039
functional polymers

552
00:20:45,909 --> 00:20:43,120
so that's that's my stick on that okay

553
00:20:48,470 --> 00:20:45,919
and then um yeah if people want to weigh

554
00:20:51,430 --> 00:20:48,480
in and uh irene

555
00:20:52,549 --> 00:20:51,440
has has some ideas on this also i

556
00:20:54,390 --> 00:20:52,559
believe

557
00:20:56,950 --> 00:20:54,400
okay yeah does anybody want to say

558
00:20:59,669 --> 00:20:56,960
anything uh or comments i know well i i

559
00:21:01,990 --> 00:20:59,679
just one one quick question uh nick what

560
00:21:03,590 --> 00:21:02,000
were those the azine b enzyme were those

561
00:21:04,870 --> 00:21:03,600
actual experimental results what were

562
00:21:07,190 --> 00:21:04,880
you showing there no i don't know these

563
00:21:08,870 --> 00:21:07,200

are simulations these are you know the

564
00:21:10,950 --> 00:21:08,880
idea of that

565
00:21:13,590 --> 00:21:10,960
okay yeah it's all computer simulations

566
00:21:15,110 --> 00:21:13,600
and that that's my idea

567
00:21:17,430 --> 00:21:15,120
yeah i think what we really got to go

568
00:21:20,070 --> 00:21:17,440
for is a push for experimental systems

569
00:21:22,070 --> 00:21:20,080
that can demonstrate emergency

570
00:21:25,830 --> 00:21:22,080
coexistence on multiple functions i

571
00:21:32,070 --> 00:21:28,549
nick do you do you want to pick up um i

572
00:21:33,870 --> 00:21:32,080
think david had made a point uh about

573
00:21:36,070 --> 00:21:33,880
assembly being downhill and the

574
00:21:37,909 --> 00:21:36,080
thermodynamics oh yeah

575
00:21:39,830 --> 00:21:37,919
yeah so david ross wrote in there should

576
00:21:42,630 --> 00:21:39,840
we not be considering the thermodynamics

577
00:21:44,310 --> 00:21:42,640
of assembly oh absolutely

578
00:21:46,070 --> 00:21:44,320
that's something lauren and i are are

579
00:21:46,950 --> 00:21:46,080
both big fans of

580
00:21:48,710 --> 00:21:46,960
um

581
00:21:50,870 --> 00:21:48,720
you know how do you get those polymers

582
00:21:53,270 --> 00:21:50,880
to start with and

583
00:21:55,190 --> 00:21:53,280
um i i think that uh

584
00:21:57,990 --> 00:21:55,200
you know having a thermodynamically

585
00:22:00,310 --> 00:21:58,000
favorite assembly is is you know

586
00:22:02,789 --> 00:22:00,320
superior to one that you know you have

587
00:22:05,510 --> 00:22:02,799
to rely upon kinetics of activation

588
00:22:07,510 --> 00:22:05,520

polymerization um because in the

589
00:22:09,070 --> 00:22:07,520
beginning it's got to be really simple

590
00:22:11,590 --> 00:22:09,080
and so if you have something that's

591
00:22:14,070 --> 00:22:11,600
thermodynamically favored

592
00:22:15,830 --> 00:22:14,080
then you can you know have the system

593
00:22:17,750 --> 00:22:15,840
run for a long time and then the

594
00:22:20,549 --> 00:22:17,760
formation of your polymers would be more

595
00:22:22,789 --> 00:22:20,559
akin to say crystallization right rather

596
00:22:24,710 --> 00:22:22,799
than radical polymerization and i think

597
00:22:26,950 --> 00:22:24,720
that's important and what's also really

598
00:22:28,710 --> 00:22:26,960
important about thermodynamics of

599
00:22:30,230 --> 00:22:28,720
assembly that goes along with what

600
00:22:33,909 --> 00:22:30,240
lauren's talking about

601
00:22:36,310 --> 00:22:33,919
in in making stable structures

602
00:22:38,070 --> 00:22:36,320
you want to find the energetically

603
00:22:40,789 --> 00:22:38,080
favored structure and you'd like that to

604
00:22:42,870 --> 00:22:40,799
be something that say is is folded and

605
00:22:43,909 --> 00:22:42,880
has lots of interactions

606
00:22:46,230 --> 00:22:43,919
and so

607
00:22:48,230 --> 00:22:46,240
then having say backbone chemistries

608
00:22:50,630 --> 00:22:48,240
that are thermodynamically favored at

609
00:22:52,870 --> 00:22:50,640
least in some parts of a cycle

610
00:22:54,789 --> 00:22:52,880
is to me that the most direct way that

611
00:22:57,909 --> 00:22:54,799
you will get to a solution to this

612
00:23:00,149 --> 00:22:57,919
problem before you have all the complex

613
00:23:01,510 --> 00:23:00,159

machinery that we know now is in the

614
00:23:03,270 --> 00:23:01,520
cell

615
00:23:04,230 --> 00:23:03,280
yeah sort of on a big question i would

616
00:23:06,390 --> 00:23:04,240
say

617
00:23:07,190 --> 00:23:06,400
in fact in this document is possibly one

618
00:23:09,510 --> 00:23:07,200
of the

619
00:23:11,830 --> 00:23:09,520
issues we could

620
00:23:13,909 --> 00:23:11,840
could treat is is the issue of

621
00:23:17,029 --> 00:23:13,919
thermodynamics versus kinetic traps

622
00:23:20,549 --> 00:23:17,039
modern biopolymers like dna and rna are

623
00:23:22,789 --> 00:23:20,559
high energy kinetic traps and is it

624
00:23:24,870 --> 00:23:22,799
is that a good model for

625
00:23:26,310 --> 00:23:24,880
ancient systems should they be closer to

626
00:23:27,350 --> 00:23:26,320
equilibrium

627
00:23:28,630 --> 00:23:27,360
or not

628
00:23:30,789 --> 00:23:28,640
so

629
00:23:35,669 --> 00:23:30,799
there's another question here uh bruce

630
00:23:38,149 --> 00:23:37,430
are you going to sing for us okay uh

631
00:23:41,110 --> 00:23:38,159
there's

632
00:23:43,190 --> 00:23:41,120
called synthesis and assembly of

633
00:23:45,669 --> 00:23:43,200
populations of stable of wigans that

634
00:23:47,430 --> 00:23:45,679
he's got that he presented last week

635
00:23:49,270 --> 00:23:47,440
so um he's looking for input on that

636
00:23:50,950 --> 00:23:49,280
document too yeah i just let me say that

637
00:23:53,430 --> 00:23:50,960
there's a series of documents that are

638
00:23:55,110 --> 00:23:53,440

kind of closely related and overlapping

639
00:23:57,190 --> 00:23:55,120
and all of this will ultimately be

640
00:23:58,310 --> 00:23:57,200
funneled into this document called the

641
00:24:00,230 --> 00:23:58,320
roadmap

642
00:24:02,710 --> 00:24:00,240
and uh so we're just working on that

643
00:24:05,510 --> 00:24:02,720
process here to get

644
00:24:07,750 --> 00:24:05,520
our some parts of that document together

645
00:24:09,669 --> 00:24:07,760
okay so uh irene did you have some

646
00:24:11,430 --> 00:24:09,679
comments yeah i'll just make one quick

647
00:24:12,950 --> 00:24:11,440
comment and then i also want to say

648
00:24:15,029 --> 00:24:12,960
reading the chat window it looks like

649
00:24:16,549 --> 00:24:15,039
people might do want you to go over the

650
00:24:18,470 --> 00:24:16,559
document itself so that might be a good

651
00:24:20,950 --> 00:24:18,480
idea i'll leave a lot of time for you so

652
00:24:22,630 --> 00:24:20,960
just my one point is about this whole

653
00:24:24,549 --> 00:24:22,640
prelude about um

654
00:24:26,549 --> 00:24:24,559
what is function and defining function i

655
00:24:28,950 --> 00:24:26,559
think nick started to get into this

656
00:24:31,830 --> 00:24:28,960
um i want to make sure that we have a

657
00:24:34,149 --> 00:24:31,840
pretty inclusive or broad perspective on

658
00:24:36,549 --> 00:24:34,159
what function is it could be

659
00:24:38,870 --> 00:24:36,559
the chemical perspective of assembly and

660
00:24:41,510 --> 00:24:38,880
catalysis but also

661
00:24:43,510 --> 00:24:41,520
even really simple physical phenomena

662
00:24:46,870 --> 00:24:43,520
like structural we think of structural

663
00:24:49,190 --> 00:24:46,880

proteins and maybe um

664
00:24:51,750 --> 00:24:49,200
if we have structural mono uh polymers

665
00:24:54,470 --> 00:24:51,760
also that could be helpful in some way

666
00:24:56,630 --> 00:24:54,480
so it is anything that that enhances the

667
00:24:58,149 --> 00:24:56,640
fitness of an organism

668
00:25:01,350 --> 00:24:58,159
um

669
00:25:04,870 --> 00:25:01,360
an organism i guess broadly defined so

670
00:25:06,950 --> 00:25:04,880
on the physical side um even osmotic

671
00:25:08,710 --> 00:25:06,960
effects that we've looked at previously

672
00:25:10,710 --> 00:25:08,720
could be of interest in terms of

673
00:25:12,710 --> 00:25:10,720
function and then on the biological side

674
00:25:14,870 --> 00:25:12,720
there's things like

675
00:25:17,590 --> 00:25:14,880
gene regulation um where you're just

676
00:25:20,070 --> 00:25:17,600
talking about a response to chemicals or

677
00:25:22,230 --> 00:25:20,080
even buffering and things like that um

678
00:25:23,590 --> 00:25:22,240
those simpler functions might actually

679
00:25:26,549 --> 00:25:23,600
be easier to

680
00:25:28,390 --> 00:25:26,559
achieve um and still interesting for for

681
00:25:29,590 --> 00:25:28,400
life um

682
00:25:32,789 --> 00:25:29,600
that's all that's the only point i

683
00:25:38,549 --> 00:25:36,310
yeah okay hi this is this is

684
00:25:41,190 --> 00:25:38,559
so go ahead somebody else comment so

685
00:25:43,350 --> 00:25:41,200
this is this is andy ellington uh hi

686
00:25:45,110 --> 00:25:43,360
um so i sort of came in a little bit

687
00:25:46,070 --> 00:25:45,120
late but i agree maybe it would be good

688
00:25:47,669 --> 00:25:46,080

to go over

689
00:25:50,710 --> 00:25:47,679
the document because i went and clicked

690
00:25:52,549 --> 00:25:50,720
on the document window and it's a rather

691
00:25:54,710 --> 00:25:52,559
general document that deals with many

692
00:25:56,310 --> 00:25:54,720
important issues and

693
00:25:57,669 --> 00:25:56,320
there is this you know perhaps slight

694
00:26:00,149 --> 00:25:57,679
impression that if we

695
00:26:03,909 --> 00:26:00,159
deal with individuals research

696
00:26:05,269 --> 00:26:03,919
um in a you know a seminar that's

697
00:26:07,590 --> 00:26:05,279
essentially about discussing the

698
00:26:09,430 --> 00:26:07,600
document that what we're really doing is

699
00:26:11,669 --> 00:26:09,440
trying to write individuals research

700
00:26:15,110 --> 00:26:11,679
into the document which would probably

701
00:26:15,120 --> 00:26:18,950
well you could have pulled me dude

702
00:26:23,750 --> 00:26:20,549
we're trying to get some conversation

703
00:26:25,909 --> 00:26:23,760
yeah so what we have okay is one of our

704
00:26:27,590 --> 00:26:25,919
perspectives on it so let's bring it up

705
00:26:30,789 --> 00:26:27,600
what we have actually the next slide

706
00:26:32,870 --> 00:26:30,799
okay now i have taken the document here

707
00:26:36,390 --> 00:26:32,880
and um

708
00:26:37,830 --> 00:26:36,400
i have um so the next the next slides

709
00:26:39,669 --> 00:26:37,840
are actually what i did is i took the

710
00:26:41,590 --> 00:26:39,679
document and i pasted it into this

711
00:26:44,230 --> 00:26:41,600
powerpoint presentation

712
00:26:45,510 --> 00:26:44,240
and what i did is um so that that's what

713
00:26:47,269 --> 00:26:45,520

basically these

714
00:26:48,950 --> 00:26:47,279
next slides which i'm flipping forward

715
00:26:50,230 --> 00:26:48,960
through and reverse through are this is

716
00:26:52,870 --> 00:26:50,240
where i go through that are the actual

717
00:26:55,190 --> 00:26:52,880
document so um we were trying to do is

718
00:26:56,870 --> 00:26:55,200
sort of generate a kind of discussion

719
00:26:58,549 --> 00:26:56,880
and some sort of framework for

720
00:27:00,310 --> 00:26:58,559
discussing the document

721
00:27:01,990 --> 00:27:00,320
so um

722
00:27:04,830 --> 00:27:02,000
and some of this actually and also i

723
00:27:08,549 --> 00:27:04,840
sent the document out to a list of

724
00:27:09,830 --> 00:27:08,559
people who i i just made up a list early

725
00:27:12,070 --> 00:27:09,840
in the week and sent it out to them and

726
00:27:13,909 --> 00:27:12,080
i got comments by some people and so

727
00:27:16,230 --> 00:27:13,919
those are some of these initials here

728
00:27:17,830 --> 00:27:16,240
this is uh this is me so that guy got

729
00:27:18,830 --> 00:27:17,840
some things back

730
00:27:21,830 --> 00:27:18,840
and

731
00:27:23,830 --> 00:27:21,840
um so if you didn't if i if i didn't

732
00:27:26,070 --> 00:27:23,840
send it to you then i'm sorry please

733
00:27:27,830 --> 00:27:26,080
send me email and in the next iterations

734
00:27:30,230 --> 00:27:27,840
i'll get you on that email with andy i

735
00:27:31,510 --> 00:27:30,240
think i did send it to you so um i'm

736
00:27:33,269 --> 00:27:31,520
sure people send me stuff all the time

737
00:27:34,710 --> 00:27:33,279
that i don't read so you know that's not

738
00:27:36,149 --> 00:27:34,720

your if not it's not your fault if i

739
00:27:38,470 --> 00:27:36,159
don't read and comment but i still just

740
00:27:40,549 --> 00:27:38,480
think that we should try and keep this

741
00:27:41,750 --> 00:27:40,559
as neutral as possible as we move

742
00:27:44,390 --> 00:27:41,760
forward

743
00:27:47,510 --> 00:27:44,400
yeah i have to say that okay all right

744
00:27:48,950 --> 00:27:47,520
let's do it so um

745
00:27:50,549 --> 00:27:48,960
the uh

746
00:27:53,190 --> 00:27:50,559
okay so maybe i'll these are comments

747
00:27:56,470 --> 00:27:53,200
that we have so this is basically them

748
00:28:00,549 --> 00:27:58,870
we can everybody i just wanted to

749
00:28:01,430 --> 00:28:00,559
to make a quick note this is lindsay

750
00:28:03,350 --> 00:28:01,440
hayes

751
00:28:05,269 --> 00:28:03,360
i just wanted to say that for any and

752
00:28:07,909 --> 00:28:05,279
all of these roadmap papers we

753
00:28:10,070 --> 00:28:07,919
appreciate contributions from everybody

754
00:28:12,630 --> 00:28:10,080
so you know particularly andy if you

755
00:28:14,070 --> 00:28:12,640
feel like this is too centered on one

756
00:28:15,909 --> 00:28:14,080
particular type of research or one

757
00:28:18,389 --> 00:28:15,919
particular groups type of research we

758
00:28:20,310 --> 00:28:18,399
really really are encouraging people to

759
00:28:22,789 --> 00:28:20,320
make comments and get involved in this

760
00:28:24,870 --> 00:28:22,799
whole process to you know make sure that

761
00:28:27,110 --> 00:28:24,880
that their particular

762
00:28:29,029 --> 00:28:27,120
interests are included in each of these

763
00:28:31,750 --> 00:28:29,039

white papers and therefore will have a

764
00:28:34,230 --> 00:28:31,760
place in the um the the final document

765
00:28:36,230 --> 00:28:34,240
that comes out of this

766
00:28:38,389 --> 00:28:36,240
and lindsey let me just chip in one

767
00:28:40,710 --> 00:28:38,399
other thought because i think we have

768
00:28:42,710 --> 00:28:40,720
several people here who haven't been to

769
00:28:45,990 --> 00:28:42,720
previous webinars so i just wanted to

770
00:28:49,190 --> 00:28:46,000
explain some terribly mechanical things

771
00:28:52,310 --> 00:28:49,200
on the front of the website you'll find

772
00:28:54,470 --> 00:28:52,320
a link to each of the white papers or

773
00:28:55,110 --> 00:28:54,480
concept papers that have been presented

774
00:29:00,070 --> 00:28:55,120
and

775
00:29:03,350 --> 00:29:00,080
presenting now is at the top of the list

776
00:29:05,029 --> 00:29:03,360
prior to the webinar it's in read-only

777
00:29:07,190 --> 00:29:05,039
mode and the only reason i'm saying this

778
00:29:10,389 --> 00:29:07,200
is you don't actually have to email it

779
00:29:12,630 --> 00:29:10,399
to anyone everyone has access to it as

780
00:29:15,990 --> 00:29:12,640
soon as the webinar finishes we flip the

781
00:29:18,549 --> 00:29:16,000
switch and it goes into comment mode um

782
00:29:20,630 --> 00:29:18,559
and uh all you need is a google docs

783
00:29:22,630 --> 00:29:20,640
account so everyone can read it right

784
00:29:24,470 --> 00:29:22,640
now and should be able to comment on it

785
00:29:27,110 --> 00:29:24,480
in half an hour's time

786
00:29:29,029 --> 00:29:27,120
okay yeah so so andy if i could if i

787
00:29:29,830 --> 00:29:29,039
could just ask real real quick so you

788
00:29:31,510 --> 00:29:29,840

know

789
00:29:33,669 --> 00:29:31,520
let's assume that just besides being

790
00:29:36,230 --> 00:29:33,679
lazy there are some of us who have not

791
00:29:37,830 --> 00:29:36,240
had a chance to really you know chime in

792
00:29:40,230 --> 00:29:37,840
until end of term

793
00:29:41,990 --> 00:29:40,240
when is the comment portion closed for

794
00:29:45,430 --> 00:29:42,000
all the documents and at what point do

795
00:29:49,190 --> 00:29:47,669
actually um can i can i field that

796
00:29:51,269 --> 00:29:49,200
question andy

797
00:29:52,950 --> 00:29:51,279
yeah sure that question from andy to

798
00:29:56,230 --> 00:29:52,960
andy um

799
00:29:57,990 --> 00:29:56,240
so the the current schedule that we have

800
00:29:59,830 --> 00:29:58,000
um you can actually if you go back and

801
00:30:02,310 --> 00:29:59,840
look um on the same page that the

802
00:30:05,430 --> 00:30:02,320
astrobiology futures page uh michael

803
00:30:08,230 --> 00:30:05,440
news presentation the the way forward uh

804
00:30:09,909 --> 00:30:08,240
sort of gives you a sense of the timing

805
00:30:13,430 --> 00:30:09,919
the goal is we're going to finish up

806
00:30:15,110 --> 00:30:13,440
with our with our final presentations

807
00:30:17,430 --> 00:30:15,120
sometime in mid

808
00:30:19,750 --> 00:30:17,440
january

809
00:30:22,149 --> 00:30:19,760
we're going to leave them open for a bit

810
00:30:25,750 --> 00:30:22,159
longer for comments and such but then

811
00:30:27,830 --> 00:30:25,760
the goal is uh in about

812
00:30:30,710 --> 00:30:27,840
starting in february and through sort of

813
00:30:32,070 --> 00:30:30,720

mid-march to start doing edits of these

814
00:30:33,990 --> 00:30:32,080
and to really start bringing them

815
00:30:35,510 --> 00:30:34,000
together either in some in-person or

816
00:30:37,909 --> 00:30:35,520
some virtual way

817
00:30:39,990 --> 00:30:37,919
we haven't quite um outlined that yet

818
00:30:41,430 --> 00:30:40,000
but the idea is basically

819
00:30:43,750 --> 00:30:41,440
it's at some point we're going to bring

820
00:30:45,029 --> 00:30:43,760
it together um and that's probably going

821
00:30:47,909 --> 00:30:45,039
to be like you said like you're asking

822
00:30:48,710 --> 00:30:47,919
for a date sometime um early february

823
00:30:50,470 --> 00:30:48,720
through

824
00:30:52,149 --> 00:30:50,480
early march

825
00:30:54,470 --> 00:30:52,159
okay so if we want to get our chits in

826
00:30:57,269 --> 00:30:54,480
we need to get them in by mid january

827
00:30:58,389 --> 00:30:57,279
early february something like that yep

828
00:31:01,110 --> 00:30:58,399
okay

829
00:31:05,110 --> 00:31:02,789
back to our presenters

830
00:31:07,590 --> 00:31:05,120
okay so um

831
00:31:08,870 --> 00:31:07,600
what i uh the the note here and this was

832
00:31:10,870 --> 00:31:08,880
actually not part of the document this

833
00:31:13,510 --> 00:31:10,880
was a note i wrote in the into the

834
00:31:15,990 --> 00:31:13,520
document that i sent out to everybody on

835
00:31:18,549 --> 00:31:16,000
monday i think but what i would like

836
00:31:20,870 --> 00:31:18,559
what i propose to do is is ask if we

837
00:31:22,870 --> 00:31:20,880
could if we could

838
00:31:25,269 --> 00:31:22,880

try to and maybe people don't agree with

839
00:31:28,149 --> 00:31:25,279
this but this was just an idea i had was

840
00:31:30,870 --> 00:31:28,159
to try to uh establish a sort of a

841
00:31:32,549 --> 00:31:30,880
temporal order to um

842
00:31:34,389 --> 00:31:32,559
increasing complexity

843
00:31:35,990 --> 00:31:34,399
of function and i can see now actually

844
00:31:37,269 --> 00:31:36,000
from listening to irene and other people

845
00:31:38,389 --> 00:31:37,279
that actually the list of function i

846
00:31:41,750 --> 00:31:38,399
have here

847
00:31:43,110 --> 00:31:41,760
is not complete but um so that basically

848
00:31:45,669 --> 00:31:43,120
we could write

849
00:31:47,750 --> 00:31:45,679
sort of our broad definition of function

850
00:31:49,350 --> 00:31:47,760
and then we could maybe

851
00:31:51,190 --> 00:31:49,360
um

852
00:31:53,509 --> 00:31:51,200
try to see if we could put things in a

853
00:31:54,710 --> 00:31:53,519
temporal order that was just an idea i

854
00:31:56,230 --> 00:31:54,720
had that

855
00:31:57,430 --> 00:31:56,240
if people

856
00:32:00,149 --> 00:31:57,440
um

857
00:32:02,870 --> 00:32:00,159
want to weigh in on it they can't i

858
00:32:05,430 --> 00:32:02,880
think that's an excellent idea

859
00:32:07,190 --> 00:32:05,440
i think that's a terrible idea

860
00:32:09,430 --> 00:32:07,200
okay well okay so what should we do

861
00:32:10,710 --> 00:32:09,440
instead

862
00:32:13,430 --> 00:32:10,720
i don't know but i mean do we need

863
00:32:14,950 --> 00:32:13,440

temporal ordering can't we just say hey

864
00:32:16,549 --> 00:32:14,960
we're going to

865
00:32:17,909 --> 00:32:16,559
require the evolution of functionality

866
00:32:19,190 --> 00:32:17,919
the evolution of functionality may have

867
00:32:21,669 --> 00:32:19,200
occurred by a variety of different

868
00:32:23,509 --> 00:32:21,679
pathways it doesn't have to occur by

869
00:32:24,870 --> 00:32:23,519
this pathway the proofs in the pudding

870
00:32:26,630 --> 00:32:24,880
how do you get to

871
00:32:28,470 --> 00:32:26,640
the functional biopolymer or the

872
00:32:30,950 --> 00:32:28,480
functional early replicator or whatever

873
00:32:32,789 --> 00:32:30,960
you want and so there may be elements of

874
00:32:34,389 --> 00:32:32,799
it and these are some of those elements

875
00:32:35,509 --> 00:32:34,399
but other you know depending upon the

876
00:32:36,710 --> 00:32:35,519
system depending on the polymer

877
00:32:39,110 --> 00:32:36,720
depending upon

878
00:32:40,710 --> 00:32:39,120
you know what what mechanism or scenario

879
00:32:43,190 --> 00:32:40,720
you pick it might have occurred in

880
00:32:44,950 --> 00:32:43,200
different orders

881
00:32:48,070 --> 00:32:44,960
maybe the right way

882
00:32:50,230 --> 00:32:48,080
not a temporal order but a

883
00:32:51,509 --> 00:32:50,240
probability relative probabilities for

884
00:32:55,029 --> 00:32:51,519
each

885
00:32:57,509 --> 00:32:56,470
which again i think would be system

886
00:32:58,710 --> 00:32:57,519
specific

887
00:33:00,549 --> 00:32:58,720
yeah

888
00:33:01,909 --> 00:33:00,559

okay but then there's there's levels of

889
00:33:03,509 --> 00:33:01,919
it and that's what laura and i were

890
00:33:05,350 --> 00:33:03,519
trying to you know when we first started

891
00:33:07,110 --> 00:33:05,360
talking about we were talking on very

892
00:33:08,070 --> 00:33:07,120
different levels lauren was talking

893
00:33:09,029 --> 00:33:08,080
about

894
00:33:11,909 --> 00:33:09,039
function

895
00:33:14,710 --> 00:33:11,919
that was more of you know associations

896
00:33:16,310 --> 00:33:14,720
even monomer associations and and i was

897
00:33:18,070 --> 00:33:16,320
thinking that when people think about

898
00:33:19,110 --> 00:33:18,080
emerging the function they're thinking

899
00:33:20,950 --> 00:33:19,120
about

900
00:33:23,350 --> 00:33:20,960
you know polymers with sequences that

901
00:33:25,269 --> 00:33:23,360
have activity right but those are you

902
00:33:27,029 --> 00:33:25,279
know one of those is

903
00:33:29,830 --> 00:33:27,039
say on the nature of the molecule

904
00:33:32,870 --> 00:33:29,840
themselves and the other is kind of

905
00:33:34,710 --> 00:33:32,880
information part of a molecule

906
00:33:36,830 --> 00:33:34,720
you know in different species

907
00:33:40,230 --> 00:33:36,840
those both

908
00:33:41,750 --> 00:33:40,240
same particular mechanisms i mean we

909
00:33:42,870 --> 00:33:41,760
both know you know from the literature

910
00:33:43,990 --> 00:33:42,880
and from experiment there are a wide

911
00:33:45,669 --> 00:33:44,000
variety

912
00:33:47,830 --> 00:33:45,679
of mechanisms like we which people

913
00:33:49,269 --> 00:33:47,840

assume functionality arises you know

914
00:33:50,789 --> 00:33:49,279
some of which pass through biopolymer

915
00:33:52,310 --> 00:33:50,799
some of which don't and some of which

916
00:33:55,350 --> 00:33:52,320
can pass through other mechanisms and

917
00:33:57,029 --> 00:33:55,360
then become biopolymers and so since in

918
00:33:59,190 --> 00:33:57,039
the end world were i think all

919
00:34:01,590 --> 00:33:59,200
interested in what either was likely to

920
00:34:04,149 --> 00:34:01,600
happen or could happen elsewhere i would

921
00:34:04,870 --> 00:34:04,159
say unconstraining this problem in terms

922
00:34:09,109 --> 00:34:04,880
of

923
00:34:10,389 --> 00:34:09,119
is is is

924
00:34:12,470 --> 00:34:10,399
necessary it's going to be system

925
00:34:15,270 --> 00:34:12,480
specific and it's probably up to

926
00:34:17,030 --> 00:34:15,280
investigators to to specify their system

927
00:34:19,430 --> 00:34:17,040
or specify their mechanism and then

928
00:34:23,270 --> 00:34:19,440
apply these different

929
00:34:24,950 --> 00:34:23,280
sort of functionalities as they wish

930
00:34:26,550 --> 00:34:24,960
i i don't see why we're getting so hung

931
00:34:28,950 --> 00:34:26,560
up on temporal order i mean it's

932
00:34:30,790 --> 00:34:28,960
increasing complexity that matters

933
00:34:31,909 --> 00:34:30,800
and i you could just drop the temporal

934
00:34:33,349 --> 00:34:31,919
order and it's not going to change

935
00:34:34,629 --> 00:34:33,359
anything

936
00:34:36,950 --> 00:34:34,639
exactly

937
00:34:39,669 --> 00:34:36,960
okay i i would argue that that com you

938
00:34:41,190 --> 00:34:39,679

know even complexity is a loaded word

939
00:34:43,510 --> 00:34:41,200
and that

940
00:34:47,750 --> 00:34:44,869
right so temporal is really loaded

941
00:34:48,790 --> 00:34:47,760
complexity is still loaded and one can

942
00:34:50,790 --> 00:34:48,800
imagine

943
00:34:52,470 --> 00:34:50,800
you know specific binding prior to

944
00:34:54,069 --> 00:34:52,480
self-assembly or specific binding being

945
00:34:55,510 --> 00:34:54,079
more probable than self-assembly and so

946
00:34:56,230 --> 00:34:55,520
on and so on again i think it's up to

947
00:35:01,349 --> 00:34:56,240
the

948
00:35:03,910 --> 00:35:01,359
individual investigators with individual

949
00:35:06,310 --> 00:35:03,920
systems to show how these play out i i

950
00:35:08,630 --> 00:35:06,320
i'm uncomfortable with making general

951
00:35:09,910 --> 00:35:08,640
sweeping statements that have no you

952
00:35:13,270 --> 00:35:09,920
know grounding

953
00:35:14,870 --> 00:35:13,280
in chemistry or molecules or

954
00:35:16,630 --> 00:35:14,880
or whatnot that that i could that i

955
00:35:18,470 --> 00:35:16,640
could at least see my way fit to to

956
00:35:20,150 --> 00:35:18,480
saying oh yeah that it happened that way

957
00:35:21,829 --> 00:35:20,160
and not that way

958
00:35:23,430 --> 00:35:21,839
i think it's just a framework right i

959
00:35:25,270 --> 00:35:23,440
don't think it's you have to say

960
00:35:27,910 --> 00:35:25,280
something so andy give us a statement

961
00:35:29,190 --> 00:35:27,920
that you would agree with

962
00:35:30,630 --> 00:35:29,200
these are all interesting

963
00:35:31,430 --> 00:35:30,640

functionalities

964
00:35:33,990 --> 00:35:31,440
um

965
00:35:35,990 --> 00:35:34,000
you know it would be you know can can

966
00:35:37,910 --> 00:35:36,000
can you individually or collectively

967
00:35:40,790 --> 00:35:37,920
show how to instantiate these

968
00:35:42,150 --> 00:35:40,800
functionalities with biopolymer systems

969
00:35:44,069 --> 00:35:42,160
of any sort i mean that would be a

970
00:35:45,109 --> 00:35:44,079
challenge to the community that doesn't

971
00:35:46,790 --> 00:35:45,119
require

972
00:35:48,710 --> 00:35:46,800
any grounding in temporal order or

973
00:35:50,550 --> 00:35:48,720
probability or complexity it's just yeah

974
00:35:52,069 --> 00:35:50,560
we recognize these they're important how

975
00:35:53,829 --> 00:35:52,079
do you get there

976
00:35:55,910 --> 00:35:53,839
there could be multiple pathways and

977
00:35:58,069 --> 00:35:55,920
those pathways could be traversed

978
00:35:59,589 --> 00:35:58,079
differently by different molecular sets

979
00:36:00,950 --> 00:35:59,599
there could be different probabilities

980
00:36:08,150 --> 00:36:00,960
depending upon the different molecular

981
00:36:11,829 --> 00:36:09,589
okay do you have more in the document do

982
00:36:13,589 --> 00:36:11,839
you want to go yeah um one of the things

983
00:36:16,069 --> 00:36:13,599
i have actually that i think got pushed

984
00:36:17,990 --> 00:36:16,079
off the page because uh

985
00:36:19,510 --> 00:36:18,000
actually early thought it was so obvious

986
00:36:21,910 --> 00:36:19,520
that i didn't i shouldn't even say it

987
00:36:24,790 --> 00:36:21,920
what was that all of this should be

988
00:36:27,349 --> 00:36:24,800

linked to experimentally addressable

989
00:36:29,670 --> 00:36:27,359
systems so that whatever we're doing

990
00:36:31,190 --> 00:36:29,680
here needs to be linked to experiments

991
00:36:32,150 --> 00:36:31,200
so um

992
00:36:34,069 --> 00:36:32,160
that was

993
00:36:35,750 --> 00:36:34,079
another question okay so now this is

994
00:36:37,589 --> 00:36:35,760
right out of the document this is you

995
00:36:38,630 --> 00:36:37,599
know we had the meeting at

996
00:36:40,870 --> 00:36:38,640
island

997
00:36:42,390 --> 00:36:40,880
and we uh

998
00:36:44,230 --> 00:36:42,400
as a group and i mean there were people

999
00:36:46,550 --> 00:36:44,240
online working on this we

1000
00:36:49,270 --> 00:36:46,560
we came up with some

1001
00:36:51,270 --> 00:36:49,280
that we thought were or some of these

1002
00:36:53,190 --> 00:36:51,280
look like statements

1003
00:37:01,349 --> 00:36:53,200
um

1004
00:37:03,109 --> 00:37:01,359
i just copied and pasted this directly

1005
00:37:04,310 --> 00:37:03,119
uh into the

1006
00:37:05,829 --> 00:37:04,320
thing and i guess i guess maybe why

1007
00:37:07,510 --> 00:37:05,839
don't i just let people read this for a

1008
00:37:25,190 --> 00:37:07,520
second before we

1009
00:37:27,990 --> 00:37:26,630
lauren while people are reading that

1010
00:37:30,069 --> 00:37:28,000
maybe i could just make the comments

1011
00:37:31,589 --> 00:37:30,079
that the point on your on on the

1012
00:37:33,430 --> 00:37:31,599
previous slide maybe it could be phrased

1013
00:37:35,109 --> 00:37:33,440

as a hypothesis and it could be like

1014
00:37:36,390 --> 00:37:35,119
addressing the question

1015
00:37:37,270 --> 00:37:36,400
whether there are general

1016
00:37:38,630 --> 00:37:37,280
uh

1017
00:37:40,470 --> 00:37:38,640
there's there are general features to

1018
00:37:43,190 --> 00:37:40,480
the temporal order or probabilities or

1019
00:37:44,870 --> 00:37:43,200
whatever um general to

1020
00:37:46,470 --> 00:37:44,880
multiple chemical systems maybe it could

1021
00:37:47,829 --> 00:37:46,480
be phrased as a question to be

1022
00:37:54,470 --> 00:37:47,839
investigated

1023
00:37:57,190 --> 00:37:55,990
um are there

1024
00:37:59,270 --> 00:37:57,200
if people have gone through this are

1025
00:38:01,589 --> 00:37:59,280
there particular points in this list

1026
00:38:04,470 --> 00:38:01,599
that people would like to discuss is

1027
00:38:07,910 --> 00:38:04,480
there

1028
00:38:14,150 --> 00:38:09,349
that think people think should be

1029
00:38:19,030 --> 00:38:16,790
these all seem like excellent questions

1030
00:38:21,030 --> 00:38:19,040
to me um because they're they're pretty

1031
00:38:23,190 --> 00:38:21,040
open-ended or even when they're asking

1032
00:38:25,109 --> 00:38:23,200
for you know this or that it's a pretty

1033
00:38:27,109 --> 00:38:25,119
general this or that so these seem like

1034
00:38:31,430 --> 00:38:27,119
to me like really good um

1035
00:38:31,440 --> 00:38:33,910
okay

1036
00:38:41,829 --> 00:38:35,829
um

1037
00:38:44,390 --> 00:38:43,190
so i think when we look at these

1038
00:38:46,390 --> 00:38:44,400

questions that we need to think about

1039
00:38:48,069 --> 00:38:46,400
them in terms of what the real road map

1040
00:38:49,910 --> 00:38:48,079
is going to be because

1041
00:38:51,670 --> 00:38:49,920
you know we can't we cannot i don't

1042
00:38:53,190 --> 00:38:51,680
think include a lot of this detail in

1043
00:38:55,109 --> 00:38:53,200
the roadmap i think the document we're

1044
00:38:56,550 --> 00:38:55,119
looking at is also

1045
00:38:58,950 --> 00:38:56,560
it's probably going to be distilled down

1046
00:38:59,750 --> 00:38:58,960
to maybe a couple sentences probably so

1047
00:39:03,750 --> 00:38:59,760
we

1048
00:39:05,910 --> 00:39:03,760
for us to think about this but um

1049
00:39:08,230 --> 00:39:05,920
somehow this has to be

1050
00:39:12,470 --> 00:39:08,240
um tuned a little bit in conjunction

1051
00:39:16,230 --> 00:39:14,390
so i just wanted to also add here um

1052
00:39:18,069 --> 00:39:16,240
this is lindsay again um one of the

1053
00:39:20,630 --> 00:39:18,079
things that we were really sort of

1054
00:39:22,790 --> 00:39:20,640
trying to encourage with some of the

1055
00:39:25,190 --> 00:39:22,800
one of the earlier papers uh included a

1056
00:39:27,190 --> 00:39:25,200
section that we called things to work on

1057
00:39:30,069 --> 00:39:27,200
in the coming 10 years

1058
00:39:32,790 --> 00:39:30,079
and that kind of using you know turning

1059
00:39:33,910 --> 00:39:32,800
these great sub questions into you know

1060
00:39:35,349 --> 00:39:33,920
where

1061
00:39:36,790 --> 00:39:35,359
you know what specifically do we think

1062
00:39:38,150 --> 00:39:36,800
we want to work on what specifically do

1063
00:39:40,069 --> 00:39:38,160

we think we can get to that kind of

1064
00:39:42,150 --> 00:39:40,079
thing in the next 10 years might be

1065
00:39:44,390 --> 00:39:42,160
something that you want a lens that you

1066
00:39:45,829 --> 00:39:44,400
want to sort of bring that view these

1067
00:39:47,349 --> 00:39:45,839
questions through

1068
00:39:51,030 --> 00:39:47,359
and think about how you want to arrange

1069
00:39:54,470 --> 00:39:52,710
so so lindsey

1070
00:39:56,230 --> 00:39:54,480
that was sort of what i was a little

1071
00:39:58,470 --> 00:39:56,240
worried about earlier i know we're

1072
00:40:00,230 --> 00:39:58,480
getting input from the community but

1073
00:40:01,990 --> 00:40:00,240
what i'm what i keep thinking is you

1074
00:40:04,390 --> 00:40:02,000
know people who haven't participated in

1075
00:40:06,630 --> 00:40:04,400
these calls or worked on these documents

1076
00:40:08,630 --> 00:40:06,640
are still out there they'll they'll

1077
00:40:10,790 --> 00:40:08,640
eventually be invited hopefully to

1078
00:40:11,670 --> 00:40:10,800
participate in the in the roadmap

1079
00:40:13,670 --> 00:40:11,680
and

1080
00:40:16,230 --> 00:40:13,680
i'm i keep worrying about the ideas we

1081
00:40:17,990 --> 00:40:16,240
haven't seen or won't see as a result of

1082
00:40:19,270 --> 00:40:18,000
these discussions and so if we target

1083
00:40:24,950 --> 00:40:19,280
specific

1084
00:40:26,470 --> 00:40:24,960
projects even rather than these very

1085
00:40:28,310 --> 00:40:26,480
interesting open questions or even the

1086
00:40:30,630 --> 00:40:28,320
previous slide or very interesting

1087
00:40:32,150 --> 00:40:30,640
functionalities that we're going to

1088
00:40:34,390 --> 00:40:32,160

unintentionally include or

1089
00:40:36,230 --> 00:40:34,400
unintentionally exclude people from the

1090
00:40:37,750 --> 00:40:36,240
greater whole

1091
00:40:39,589 --> 00:40:37,760
and we agree um this is actually

1092
00:40:41,190 --> 00:40:39,599
something that michael and mary and i

1093
00:40:43,030 --> 00:40:41,200
and sean and andy have been talking a

1094
00:40:45,670 --> 00:40:43,040
lot about is trying to make sure that

1095
00:40:47,589 --> 00:40:45,680
that not just questions or sub-questions

1096
00:40:49,030 --> 00:40:47,599
or topics that could be you know that

1097
00:40:51,349 --> 00:40:49,040
could be into any of the individual

1098
00:40:54,069 --> 00:40:51,359
papers that might be excluded but even

1099
00:40:57,190 --> 00:40:54,079
broader topics that aren't that that you

1100
00:40:58,630 --> 00:40:57,200
know people feel might be missed um if

1101
00:41:01,430 --> 00:40:58,640
you feel i mean that's part of the

1102
00:41:04,069 --> 00:41:01,440
reason during the kickoff we showed the

1103
00:41:06,950 --> 00:41:04,079
um the spider diagram that we did of the

1104
00:41:08,470 --> 00:41:06,960
topic papers that we had and we said you

1105
00:41:11,750 --> 00:41:08,480
know these are the topic papers that we

1106
00:41:13,430 --> 00:41:11,760
have so far if anybody feels like you

1107
00:41:16,309 --> 00:41:13,440
know they can't see their research in

1108
00:41:17,510 --> 00:41:16,319
here or that they want you know that

1109
00:41:19,750 --> 00:41:17,520
they want

1110
00:41:21,990 --> 00:41:19,760
they think that something was missed

1111
00:41:24,470 --> 00:41:22,000
we have encouraged and are continuing to

1112
00:41:26,470 --> 00:41:24,480
encourage anybody to say hey i'm going

1113
00:41:27,270 --> 00:41:26,480

to write a white paper on this

1114
00:41:28,470 --> 00:41:27,280
um

1115
00:41:29,990 --> 00:41:28,480
you know do you think that'll fit in

1116
00:41:31,589 --> 00:41:30,000
that kind of thing

1117
00:41:33,670 --> 00:41:31,599
bring some friends you know some other

1118
00:41:35,829 --> 00:41:33,680
people you work with to help you

1119
00:41:37,190 --> 00:41:35,839
get a topic paper written

1120
00:41:38,870 --> 00:41:37,200
since we are going to be using these

1121
00:41:40,230 --> 00:41:38,880
topic papers to assemble the thing this

1122
00:41:42,150 --> 00:41:40,240
is why we've tried to you know we've

1123
00:41:44,710 --> 00:41:42,160
been trying to get as much input from

1124
00:41:46,390 --> 00:41:44,720
the community as possible if if you see

1125
00:41:47,990 --> 00:41:46,400
something that's missing please let us

1126
00:41:49,589 --> 00:41:48,000
know you know try and work on a white

1127
00:41:50,870 --> 00:41:49,599
paper or bring some people together or

1128
00:41:53,430 --> 00:41:50,880
whatever

1129
00:41:55,109 --> 00:41:53,440
is that uh that on the same time frame

1130
00:41:56,790 --> 00:41:55,119
so you would have to have that

1131
00:41:58,870 --> 00:41:56,800
by mid-january or do you need that

1132
00:42:00,950 --> 00:41:58,880
sooner um no that's on that that's on

1133
00:42:02,470 --> 00:42:00,960
the same time frame um we would hope

1134
00:42:03,670 --> 00:42:02,480
that if you could get it you know if you

1135
00:42:05,430 --> 00:42:03,680
could get i mean these aren't these are

1136
00:42:08,069 --> 00:42:05,440
white papers right so they're relatively

1137
00:42:09,589 --> 00:42:08,079
short um and you know we don't need any

1138
00:42:13,109 --> 00:42:09,599

additional research really going into

1139
00:42:14,550 --> 00:42:13,119
them um but the the hope is that if you

1140
00:42:16,550 --> 00:42:14,560
guys could get a white paper together if

1141
00:42:18,950 --> 00:42:16,560
you guys feel like there's some topic um

1142
00:42:21,270 --> 00:42:18,960
we do still have some time at the end of

1143
00:42:24,230 --> 00:42:21,280
january uh that is still available for

1144
00:42:25,589 --> 00:42:24,240
white papers to be presented um so you

1145
00:42:27,430 --> 00:42:25,599
know we're not

1146
00:42:28,870 --> 00:42:27,440
we we want to we would we would rather

1147
00:42:30,309 --> 00:42:28,880
keep this going a little bit longer and

1148
00:42:32,390 --> 00:42:30,319
make sure we get the right amount of

1149
00:42:33,349 --> 00:42:32,400
feedback then cut it off and miss

1150
00:42:35,589 --> 00:42:33,359
something

1151
00:42:36,390 --> 00:42:35,599
right okay well that's great

1152
00:42:39,349 --> 00:42:36,400
yeah

1153
00:42:42,950 --> 00:42:39,359
and andy i see just put up the um

1154
00:42:44,470 --> 00:42:42,960
uh the link to the spider diagram um

1155
00:42:46,390 --> 00:42:44,480
it's again if you go to that website

1156
00:42:48,150 --> 00:42:46,400
astrobiology future you can see

1157
00:42:49,430 --> 00:42:48,160
everything that's been done and please

1158
00:42:51,109 --> 00:42:49,440
please if you if you think that

1159
00:42:53,270 --> 00:42:51,119
something's missing we would really

1160
00:42:57,510 --> 00:42:53,280
really like to get that that in right so

1161
00:43:01,030 --> 00:42:58,790
sorry i think that's a great i think

1162
00:43:02,710 --> 00:43:01,040
that's a fine response lindsey but it

1163
00:43:03,910 --> 00:43:02,720

sort of a little bit misses my point

1164
00:43:06,069 --> 00:43:03,920
which is

1165
00:43:07,910 --> 00:43:06,079
for the people who don't participate

1166
00:43:10,230 --> 00:43:07,920
yeah sure i can go and try and cover the

1167
00:43:11,990 --> 00:43:10,240
universe of ideas not represented i'm

1168
00:43:13,750 --> 00:43:12,000
not going to do a very good job of that

1169
00:43:17,270 --> 00:43:13,760
i keep thinking about you know a younger

1170
00:43:19,190 --> 00:43:17,280
nick hood who you know has these amazing

1171
00:43:21,030 --> 00:43:19,200
you know really novel ideas that

1172
00:43:23,829 --> 00:43:21,040
probably nobody but nick hud is thinking

1173
00:43:26,630 --> 00:43:23,839
about and if we weren't lucky enough to

1174
00:43:28,870 --> 00:43:26,640
you know capture the young girl nick hud

1175
00:43:29,990 --> 00:43:28,880
early on and they just happened across

1176
00:43:31,510 --> 00:43:30,000
this call

1177
00:43:33,030 --> 00:43:31,520
how would we know even you know that

1178
00:43:35,750 --> 00:43:33,040
there's something there for them i think

1179
00:43:37,670 --> 00:43:35,760
in some ways the more general we are

1180
00:43:39,349 --> 00:43:37,680
in stating the idea of stating the

1181
00:43:41,430 --> 00:43:39,359
problem stating the questions the more

1182
00:43:44,069 --> 00:43:41,440
likely that we'll we'll cast a broad net

1183
00:43:45,990 --> 00:43:44,079
to find novel solutions not just commun

1184
00:43:47,990 --> 00:43:46,000
solutions by the community that already

1185
00:43:50,230 --> 00:43:48,000
exists and is already participating but

1186
00:43:51,829 --> 00:43:50,240
by lots of other people so so that's why

1187
00:43:53,829 --> 00:43:51,839
i get wary when it's like well let's

1188
00:43:55,030 --> 00:43:53,839

talk about this aspect of research or

1189
00:43:57,109 --> 00:43:55,040
that aspect of research or this

1190
00:43:59,510 --> 00:43:57,119
particular order or whatnot i really

1191
00:44:01,030 --> 00:43:59,520
don't want to lose a broader community

1192
00:44:02,309 --> 00:44:01,040
where there are fresh ideas that we may

1193
00:44:03,750 --> 00:44:02,319
not have thought of

1194
00:44:05,750 --> 00:44:03,760
so so basically what you're trying to

1195
00:44:08,950 --> 00:44:05,760
say is you're speaking you want to be

1196
00:44:09,910 --> 00:44:08,960
the voice of keeping the final road map

1197
00:44:12,150 --> 00:44:09,920
which we're actually calling the

1198
00:44:13,270 --> 00:44:12,160
strategy uh keeping that as broad as

1199
00:44:14,069 --> 00:44:13,280
possible

1200
00:44:16,790 --> 00:44:14,079
yeah

1201
00:44:19,030 --> 00:44:16,800
okay we will definitely um that's a good

1202
00:44:21,270 --> 00:44:19,040
point um and when we and when we get to

1203
00:44:23,829 --> 00:44:21,280
the stage of putting this all together

1204
00:44:25,990 --> 00:44:23,839
we will definitely try and do that um

1205
00:44:27,829 --> 00:44:26,000
but you know in the meantime the part of

1206
00:44:29,270 --> 00:44:27,839
the reason that we wanted to

1207
00:44:31,030 --> 00:44:29,280
you know get as many of the community

1208
00:44:32,790 --> 00:44:31,040
involved is to hope that you know

1209
00:44:35,349 --> 00:44:32,800
somebody may know that other you know

1210
00:44:37,589 --> 00:44:35,359
the the young nick hud as you put it um

1211
00:44:39,430 --> 00:44:37,599
and get you know and and

1212
00:44:41,510 --> 00:44:39,440
speak up for them or you know add a

1213
00:44:43,349 --> 00:44:41,520

little hey maybe we should think about

1214
00:44:44,390 --> 00:44:43,359
this or that kind of thing but i see

1215
00:44:45,510 --> 00:44:44,400
what you're saying i say i think you've

1216
00:44:46,790 --> 00:44:45,520
got a good point tonight and i

1217
00:44:52,390 --> 00:44:46,800
understand what you're getting at i

1218
00:44:57,589 --> 00:44:54,790
so if that's is that does that sound

1219
00:45:00,710 --> 00:44:59,190
yeah sure that's great

1220
00:45:02,870 --> 00:45:00,720
yeah i'm i'm just trying not to

1221
00:45:04,470 --> 00:45:02,880
interrupt sorry sorry yeah so that was i

1222
00:45:06,710 --> 00:45:04,480
mean that was i guess i guess if that's

1223
00:45:08,790 --> 00:45:06,720
your point i i agree that keeping the

1224
00:45:11,910 --> 00:45:08,800
final paper general is is a good point

1225
00:45:14,390 --> 00:45:11,920
um and we will try and do that

1226
00:45:16,230 --> 00:45:14,400
lauren we can hear you so i'll also go

1227
00:45:18,470 --> 00:45:16,240
right ahead sorry

1228
00:45:19,510 --> 00:45:18,480
um i just uh want to say one thing i

1229
00:45:21,349 --> 00:45:19,520
mean i guess

1230
00:45:22,630 --> 00:45:21,359
uh maybe this was misunderstood but in

1231
00:45:25,030 --> 00:45:22,640
the beginning of this

1232
00:45:27,750 --> 00:45:25,040
talk i just i thought i should just try

1233
00:45:29,589 --> 00:45:27,760
to present some things to stimulate the

1234
00:45:31,670 --> 00:45:29,599
discussion honestly that is not my

1235
00:45:34,390 --> 00:45:31,680
research that's not the research i do

1236
00:45:37,349 --> 00:45:34,400
it's just that the title of the talk was

1237
00:45:38,870 --> 00:45:37,359
um i mean the title of our paper was on

1238
00:45:40,630 --> 00:45:38,880

assembly and i thought you know if we

1239
00:45:43,270 --> 00:45:40,640
had sort of a detailed talk about what

1240
00:45:44,710 --> 00:45:43,280
assembly was or i i mean it was on

1241
00:45:46,470 --> 00:45:44,720
function i just wanted to sort of direct

1242
00:45:48,710 --> 00:45:46,480
the talk to the definition of function

1243
00:45:50,150 --> 00:45:48,720
but honestly i didn't mean to

1244
00:45:51,430 --> 00:45:50,160
uh to

1245
00:45:54,390 --> 00:45:51,440
to give the impression that we were

1246
00:45:56,790 --> 00:45:54,400
focusing it on some detailed um kind of

1247
00:45:58,950 --> 00:45:56,800
research so if that was the impression

1248
00:46:01,430 --> 00:45:58,960
that was given then i'm sorry for that

1249
00:46:03,589 --> 00:46:01,440
um also there david ross had a statement

1250
00:46:06,630 --> 00:46:03,599
there about thermodynamics

1251
00:46:08,790 --> 00:46:06,640
and i mean what we should do david is uh

1252
00:46:10,630 --> 00:46:08,800
just you know during the editing process

1253
00:46:12,230 --> 00:46:10,640
i mean just make sure your comments you

1254
00:46:13,750 --> 00:46:12,240
know i think your ideas are really good

1255
00:46:14,790 --> 00:46:13,760
and we should just make sure they get

1256
00:46:16,630 --> 00:46:14,800
worked in

1257
00:46:18,309 --> 00:46:16,640
um just at this point i don't think we

1258
00:46:20,950 --> 00:46:18,319
can really edit that and add it in here

1259
00:46:22,390 --> 00:46:20,960
but that should definitely be here

1260
00:46:23,270 --> 00:46:22,400
so um

1261
00:46:25,270 --> 00:46:23,280
so

1262
00:46:26,950 --> 00:46:25,280
you just have to kind of keep

1263
00:46:29,109 --> 00:46:26,960

keep after it and make sure that your

1264
00:46:31,510 --> 00:46:29,119
comments get in here

1265
00:46:34,550 --> 00:46:31,520
okay are there are there other comments

1266
00:46:34,560 --> 00:46:38,390
okay i'm gonna go to the next page

1267
00:46:38,400 --> 00:46:40,870
okay

1268
00:46:46,710 --> 00:46:42,950
yes yeah sorry

1269
00:46:47,750 --> 00:46:46,720
so uh this is lucas i was uh curious

1270
00:46:49,990 --> 00:46:47,760
um

1271
00:46:51,190 --> 00:46:50,000
about this question of what constitutes

1272
00:46:53,589 --> 00:46:51,200
a function

1273
00:46:55,990 --> 00:46:53,599
and i think well i don't think there's a

1274
00:46:57,589 --> 00:46:56,000
strict rigorous answer for that but it

1275
00:46:59,430 --> 00:46:57,599
might be useful in a document somewhere

1276
00:47:00,470 --> 00:46:59,440
to have a short list of particular

1277
00:47:02,710 --> 00:47:00,480
functions

1278
00:47:04,470 --> 00:47:02,720
uh like the the one you had in your

1279
00:47:06,870 --> 00:47:04,480
comment i agree

1280
00:47:10,470 --> 00:47:06,880
i'm suspicious of putting it in any

1281
00:47:11,589 --> 00:47:10,480
particular order um but i do think that

1282
00:47:12,950 --> 00:47:11,599
there's

1283
00:47:15,589 --> 00:47:12,960
for me i'm

1284
00:47:16,309 --> 00:47:15,599
still unclear exactly what constitutes

1285
00:47:18,309 --> 00:47:16,319
uh

1286
00:47:19,510 --> 00:47:18,319
what i suppose is a biological function

1287
00:47:22,950 --> 00:47:19,520
as opposed to

1288
00:47:28,150 --> 00:47:26,710

right i agree and i think um

1289
00:47:30,230 --> 00:47:28,160
you know i think it's something that

1290
00:47:31,190 --> 00:47:30,240
this group could hash out i mean i

1291
00:47:32,550 --> 00:47:31,200
actually

1292
00:47:34,950 --> 00:47:32,560
even though i was thinking in such a

1293
00:47:37,430 --> 00:47:34,960
reductionist term i actually like

1294
00:47:38,790 --> 00:47:37,440
uh irene's definition better than mine

1295
00:47:40,309 --> 00:47:38,800
basically a function is something that

1296
00:47:43,910 --> 00:47:40,319
confers advantage is that what you said

1297
00:47:47,750 --> 00:47:45,510
something that increases the fitness of

1298
00:47:48,950 --> 00:47:47,760
the organ increases fitness yeah so and

1299
00:47:50,870 --> 00:47:48,960
that could be

1300
00:47:53,030 --> 00:47:50,880
you could sort of use that definition on

1301
00:47:55,270 --> 00:47:53,040
many many levels so i think

1302
00:47:56,790 --> 00:47:55,280
i think that's a good deal but that's

1303
00:47:59,109 --> 00:47:56,800
that's what this group needs to kind of

1304
00:48:01,030 --> 00:47:59,119
hash out because i mean we can't

1305
00:48:02,630 --> 00:48:01,040
in this document in the final document

1306
00:48:04,069 --> 00:48:02,640
we're not going to have a page to talk

1307
00:48:05,589 --> 00:48:04,079
about what is function and what's not

1308
00:48:07,990 --> 00:48:05,599
function we have to be

1309
00:48:09,910 --> 00:48:08,000
really concise and very general and so

1310
00:48:12,550 --> 00:48:09,920
that people who come along with things

1311
00:48:14,309 --> 00:48:12,560
we haven't anticipated don't get

1312
00:48:16,390 --> 00:48:14,319
don't get ruled out because of it like

1313
00:48:18,710 --> 00:48:16,400

andy said that that's a really important

1314
00:48:22,069 --> 00:48:18,720
uh consideration it has to be

1315
00:48:23,750 --> 00:48:22,079
a general you know it has to last for

1316
00:48:26,549 --> 00:48:23,760
uh through a period of time where things

1317
00:48:29,109 --> 00:48:26,559
are happening that we're not foreseen

1318
00:48:31,670 --> 00:48:29,119
yeah so lauren if i might say i i wasn't

1319
00:48:33,510 --> 00:48:31,680
you know accusing you of presenting a a

1320
00:48:35,510 --> 00:48:33,520
specific view that was

1321
00:48:37,750 --> 00:48:35,520
self-serving but when i've done this

1322
00:48:39,510 --> 00:48:37,760
before in other contexts

1323
00:48:42,950 --> 00:48:39,520
you know it's a little weird in this

1324
00:48:44,069 --> 00:48:42,960
context because you know it the goal

1325
00:48:45,750 --> 00:48:44,079
of

1326
00:48:48,069 --> 00:48:45,760
the the road map

1327
00:48:50,630 --> 00:48:48,079
is more tenuous than let's say when we

1328
00:48:52,150 --> 00:48:50,640
we do it for darpa and you know the goal

1329
00:48:53,910 --> 00:48:52,160
is you know make a better bomb or

1330
00:48:55,349 --> 00:48:53,920
whatever i mean so

1331
00:48:57,030 --> 00:48:55,359
although the goals are more tenuous i

1332
00:48:58,870 --> 00:48:57,040
like the idea that

1333
00:49:00,710 --> 00:48:58,880
if we have something we're attempting to

1334
00:49:02,710 --> 00:49:00,720
achieve and in this case let's just call

1335
00:49:04,870 --> 00:49:02,720
it a living system and there may be a

1336
00:49:06,309 --> 00:49:04,880
huge variety of pathways by which one

1337
00:49:07,750 --> 00:49:06,319
could reach that living system and also

1338
00:49:09,589 --> 00:49:07,760

a huge number of questions one of which

1339
00:49:11,430 --> 00:49:09,599
we just heard brought up about chemical

1340
00:49:12,710 --> 00:49:11,440
versus biological functionality and what

1341
00:49:14,710 --> 00:49:12,720
that even means

1342
00:49:16,549 --> 00:49:14,720
that we leave it to the individual

1343
00:49:18,549 --> 00:49:16,559
investigators to

1344
00:49:21,109 --> 00:49:18,559
almost define their own terms define

1345
00:49:23,190 --> 00:49:21,119
their own paths to find a lot of things

1346
00:49:25,510 --> 00:49:23,200
rather than having sort of a group think

1347
00:49:26,470 --> 00:49:25,520
and even as genteel as this group think

1348
00:49:28,790 --> 00:49:26,480
is

1349
00:49:32,390 --> 00:49:28,800
be what directs people

1350
00:49:33,589 --> 00:49:32,400
to a particular path and and so that's

1351
00:49:35,589 --> 00:49:33,599
the only thing i want to emphasize is i

1352
00:49:37,510 --> 00:49:35,599
like the idea that this is essentially a

1353
00:49:39,270 --> 00:49:37,520
giant biotechnology project geared

1354
00:49:41,750 --> 00:49:39,280
towards making a living system that's

1355
00:49:44,150 --> 00:49:41,760
just my own view of it you can have

1356
00:49:46,309 --> 00:49:44,160
yours but if that if that resonates with

1357
00:49:49,510 --> 00:49:46,319
anybody then sure whatever gets us there

1358
00:49:54,069 --> 00:49:51,910
okay yeah i think we're all on agreement

1359
00:49:56,069 --> 00:49:54,079
with that uh one thing i think that

1360
00:49:57,910 --> 00:49:56,079
whatever the final document is i think

1361
00:49:59,270 --> 00:49:57,920
these discussions are very good because

1362
00:50:01,589 --> 00:49:59,280
it um

1363
00:50:03,510 --> 00:50:01,599

you know it helps us i have to say that

1364
00:50:06,710 --> 00:50:03,520
i never really thought about what is

1365
00:50:09,589 --> 00:50:06,720
functioned uh carefully i guess until i

1366
00:50:11,910 --> 00:50:09,599
until this morning and so um

1367
00:50:13,190 --> 00:50:11,920
i think this process is good for all of

1368
00:50:15,030 --> 00:50:13,200
us

1369
00:50:16,230 --> 00:50:15,040
okay uh

1370
00:50:18,150 --> 00:50:16,240
i'm going to the next page are we all

1371
00:50:19,109 --> 00:50:18,160
good on that

1372
00:50:22,549 --> 00:50:19,119
okay

1373
00:50:23,589 --> 00:50:22,559
all right so this is also out of the uh

1374
00:50:28,470 --> 00:50:23,599
um

1375
00:50:30,069 --> 00:50:28,480
uh

1376
00:50:32,150 --> 00:50:30,079
versus function and i have to say i

1377
00:50:34,790 --> 00:50:32,160
didn't really understand all of this i

1378
00:50:36,630 --> 00:50:34,800
just took it as it was um

1379
00:50:42,710 --> 00:50:36,640
so let's just take a minute and read

1380
00:50:42,720 --> 00:50:59,109
so

1381
00:51:02,549 --> 00:51:01,349
and here i confess i put iron in there

1382
00:51:04,230 --> 00:51:02,559
because that's my own work i'll take

1383
00:51:06,309 --> 00:51:04,240
that out i was just like i'm so

1384
00:51:09,190 --> 00:51:06,319
interesting

1385
00:51:26,790 --> 00:51:09,200
i'll get that out i'm sorry

1386
00:51:29,829 --> 00:51:28,390
if david's on the call so david what do

1387
00:51:31,349 --> 00:51:29,839
you think about the question you know

1388
00:51:33,349 --> 00:51:31,359

what mathematical rules lead from

1389
00:51:35,670 --> 00:51:33,359
equilibrium to non-equilibrium catalysis

1390
00:51:37,510 --> 00:51:35,680
does that begin to sort of

1391
00:51:40,470 --> 00:51:37,520
deal with your questions regarding

1392
00:51:42,309 --> 00:51:40,480
equilibrium and kinetics of assembly

1393
00:51:43,270 --> 00:51:42,319
yeah can you hear me

1394
00:51:46,150 --> 00:51:43,280
yeah

1395
00:51:49,910 --> 00:51:46,160
this properly

1396
00:51:51,349 --> 00:51:49,920
uh it it gets there perhaps um it's

1397
00:51:54,069 --> 00:51:51,359
still a rather i mean that that

1398
00:51:55,510 --> 00:51:54,079
statement seems to me a little um

1399
00:51:57,589 --> 00:51:55,520
well it's just one statement one

1400
00:51:59,190 --> 00:51:57,599
sentence

1401
00:52:01,109 --> 00:51:59,200
the other thing i was i was gonna point

1402
00:52:02,950 --> 00:52:01,119
to that exact statement too and to say

1403
00:52:04,470 --> 00:52:02,960
what you had said about thermodynamics

1404
00:52:08,390 --> 00:52:04,480
and kinetics can you

1405
00:52:10,630 --> 00:52:08,400
replace mathematical rules with say

1406
00:52:12,910 --> 00:52:10,640
you know chemical rules you know and

1407
00:52:14,470 --> 00:52:12,920
then having in parentheses you know

1408
00:52:16,829 --> 00:52:14,480
thermodynamics

1409
00:52:19,030 --> 00:52:16,839
kinetics lead from equilibrium to

1410
00:52:21,510 --> 00:52:19,040
non-equilibrium catalysis or

1411
00:52:22,710 --> 00:52:21,520
you know to function right but this is

1412
00:52:24,710 --> 00:52:22,720
one thing there

1413
00:52:26,710 --> 00:52:24,720

with um you know in the context of what

1414
00:52:28,230 --> 00:52:26,720
what andy's been saying i you know i

1415
00:52:29,829 --> 00:52:28,240
really agree with him

1416
00:52:32,309 --> 00:52:29,839
that we don't want to be restricted

1417
00:52:35,030 --> 00:52:32,319
because you know it's an understatement

1418
00:52:36,790 --> 00:52:35,040
to say that none of us and and even as a

1419
00:52:38,790 --> 00:52:36,800
group that we have all the answers and

1420
00:52:41,430 --> 00:52:38,800
know what's coming in the next few years

1421
00:52:42,950 --> 00:52:41,440
right that's that's for darn sure

1422
00:52:45,109 --> 00:52:42,960
but yet you still want to give a

1423
00:52:47,510 --> 00:52:45,119
document where you do have

1424
00:52:49,030 --> 00:52:47,520
you know maybe some useful things

1425
00:52:52,230 --> 00:52:49,040
in there to

1426
00:52:53,910 --> 00:52:52,240
you know help direct in some way such as

1427
00:52:55,829 --> 00:52:53,920
don't violate the second law of

1428
00:52:57,670 --> 00:52:55,839
thermodynamics right

1429
00:52:58,549 --> 00:52:57,680
that's a good start

1430
00:53:01,190 --> 00:52:58,559
you know

1431
00:53:03,270 --> 00:53:01,200
and i think that

1432
00:53:05,349 --> 00:53:03,280
what david wrote about

1433
00:53:07,030 --> 00:53:05,359
thermodynamics and kinetics i really

1434
00:53:09,109 --> 00:53:07,040
like things like that because what

1435
00:53:11,349 --> 00:53:09,119
you're saying is you know we want to

1436
00:53:14,230 --> 00:53:11,359
know we want to understand how you go to

1437
00:53:16,069 --> 00:53:14,240
function but ultimately these are

1438
00:53:17,910 --> 00:53:16,079

chemicals these are molecules right so

1439
00:53:20,470 --> 00:53:17,920
they have to obey these rules of

1440
00:53:22,309 --> 00:53:20,480
chemistry right that's right this is

1441
00:53:23,829 --> 00:53:22,319
also where when you're talking about you

1442
00:53:26,870 --> 00:53:23,839
know it's got to be connected to

1443
00:53:29,670 --> 00:53:26,880
experiment okay yes but you could have a

1444
00:53:31,510 --> 00:53:29,680
theoretician that is putting in you know

1445
00:53:33,670 --> 00:53:31,520
the kinetics and thermodynamics and then

1446
00:53:34,950 --> 00:53:33,680
defines these are the parameters in

1447
00:53:36,710 --> 00:53:34,960
chemical space that you should be

1448
00:53:38,950 --> 00:53:36,720
looking for and that could be very

1449
00:53:41,430 --> 00:53:38,960
useful but i think eventually you want

1450
00:53:43,670 --> 00:53:41,440
to guide people away from

1451
00:53:45,589 --> 00:53:43,680
you know being free of any of that where

1452
00:53:48,150 --> 00:53:45,599
it's just angle is the beagle of the c

1453
00:53:49,190 --> 00:53:48,160
and look i've made a hyper cycle right

1454
00:53:50,710 --> 00:53:49,200
you have to

1455
00:53:53,190 --> 00:53:50,720
you know

1456
00:53:54,870 --> 00:53:53,200
they don't work by the way but uh

1457
00:53:57,910 --> 00:53:54,880
yeah if one looks at it they look good

1458
00:54:02,390 --> 00:53:59,910
that's right the the foundation of all

1459
00:54:03,990 --> 00:54:02,400
of this it seems to me are the obviously

1460
00:54:05,829 --> 00:54:04,000
is is the

1461
00:54:08,230 --> 00:54:05,839
the thermodynamics and ultimately the

1462
00:54:10,390 --> 00:54:08,240
kinetics there are genetic limitations

1463
00:54:13,349 --> 00:54:10,400

there are diffusion limitations

1464
00:54:15,589 --> 00:54:13,359
and those those issues are in my view

1465
00:54:17,990 --> 00:54:15,599
once again the foundation of all of this

1466
00:54:19,910 --> 00:54:18,000
and when you have aqueous media

1467
00:54:21,109 --> 00:54:19,920
you got i mean i

1468
00:54:23,589 --> 00:54:21,119
you know that

1469
00:54:25,510 --> 00:54:23,599
that presents a number of problems that

1470
00:54:27,349 --> 00:54:25,520
i think have to be dealt with have to be

1471
00:54:29,270 --> 00:54:27,359
dealt with directly with people who

1472
00:54:30,870 --> 00:54:29,280
understand this sort of thing

1473
00:54:32,870 --> 00:54:30,880
yeah but i don't know i think that many

1474
00:54:34,790 --> 00:54:32,880
of this i have no i have no dog in this

1475
00:54:36,470 --> 00:54:34,800
fight this is just i want science right

1476
00:54:37,589 --> 00:54:36,480
that's my view here

1477
00:54:39,589 --> 00:54:37,599
but i think that's a that's a great

1478
00:54:41,990 --> 00:54:39,599
that's a great point if only because you

1479
00:54:42,790 --> 00:54:42,000
know a i think hyper cycles can work and

1480
00:54:45,589 --> 00:54:42,800
b

1481
00:54:48,069 --> 00:54:45,599
restricted conditions under which they

1482
00:54:49,589 --> 00:54:48,079
work and the intersection between you

1483
00:54:51,030 --> 00:54:49,599
know where hypocycles work and what

1484
00:54:53,190 --> 00:54:51,040
conditions they work under which may

1485
00:54:54,710 --> 00:54:53,200
very well be non-aqueous non-diffusion

1486
00:54:55,910 --> 00:54:54,720
or slow diffusion

1487
00:54:57,990 --> 00:54:55,920
conditions

1488
00:54:59,109 --> 00:54:58,000

is an interesting basic question could

1489
00:55:00,309 --> 00:54:59,119
be approached mathematically and

1490
00:55:01,750 --> 00:55:00,319
theoretically could potentially be

1491
00:55:03,589 --> 00:55:01,760
approached with should be approached

1492
00:55:06,150 --> 00:55:03,599
with experimental systems but i think

1493
00:55:07,670 --> 00:55:06,160
it's it's precisely the prejudices that

1494
00:55:10,069 --> 00:55:07,680
you that you suggest david which are

1495
00:55:11,990 --> 00:55:10,079
great prejudices that should guide us

1496
00:55:13,750 --> 00:55:12,000
but not but not limit us they should be

1497
00:55:15,829 --> 00:55:13,760
the basis for questions which is how

1498
00:55:17,829 --> 00:55:15,839
you've been posing them but but that's

1499
00:55:19,510 --> 00:55:17,839
that's why i've sort of been

1500
00:55:21,750 --> 00:55:19,520
pushing back just a little at a couple

1501
00:55:24,470 --> 00:55:21,760
of points it's like wow if anything

1502
00:55:27,109 --> 00:55:24,480
lauren's lauren's diagrams are too

1503
00:55:28,870 --> 00:55:27,119
seductive um you know if we get away

1504
00:55:30,230 --> 00:55:28,880
from these seductive diagrams you know

1505
00:55:32,150 --> 00:55:30,240
what else what else is out there and how

1506
00:55:33,750 --> 00:55:32,160
can we state these more

1507
00:55:35,270 --> 00:55:33,760
hypothetical or abstract questions so

1508
00:55:38,390 --> 00:55:35,280
that we can get lauren's diagrams and

1509
00:55:39,829 --> 00:55:38,400
others as a as well and then get to as

1510
00:55:40,950 --> 00:55:39,839
nick was saying these these these neat

1511
00:55:43,670 --> 00:55:40,960
questions about

1512
00:55:45,510 --> 00:55:43,680
well even if there was a a a an

1513
00:55:47,510 --> 00:55:45,520

experimental system or or something

1514
00:55:49,670 --> 00:55:47,520
where we could imagine instantiation

1515
00:55:53,990 --> 00:55:49,680
what subset or what universe would that

1516
00:55:57,829 --> 00:55:55,910
i guess i would like to give a different

1517
00:56:00,069 --> 00:55:57,839
uh slightly different perspective on

1518
00:56:02,549 --> 00:56:00,079
this i i don't really see that the

1519
00:56:03,990 --> 00:56:02,559
mathematical rules uh are going to be

1520
00:56:05,190 --> 00:56:04,000
all that useful

1521
00:56:06,950 --> 00:56:05,200
i mean i understand you know the

1522
00:56:08,870 --> 00:56:06,960
fundamental basis of it but what we

1523
00:56:10,710 --> 00:56:08,880
really need is to address number two

1524
00:56:12,630 --> 00:56:10,720
there what functionalities are plausible

1525
00:56:14,789 --> 00:56:12,640
in realistic geological environments

1526
00:56:17,270 --> 00:56:14,799
which by definition are aqueous

1527
00:56:19,349 --> 00:56:17,280
environment or

1528
00:56:20,630 --> 00:56:19,359
sub-aerial you know surface environments

1529
00:56:23,910 --> 00:56:20,640
things of that sort

1530
00:56:25,430 --> 00:56:23,920
but i i mean to me this is uh i would

1531
00:56:27,109 --> 00:56:25,440
love to see this

1532
00:56:29,510 --> 00:56:27,119
document really emphasize the

1533
00:56:32,069 --> 00:56:29,520
experimentation and the connection to

1534
00:56:33,510 --> 00:56:32,079
the geological environment that's that's

1535
00:56:37,270 --> 00:56:33,520
where i see

1536
00:56:41,589 --> 00:56:38,950
well i'll get off in a moment i just

1537
00:56:44,230 --> 00:56:41,599
want to say that obviously the laws of

1538
00:56:46,150 --> 00:56:44,240

physics and chemistry ultimately are the

1539
00:56:48,390 --> 00:56:46,160
basis of all of this and

1540
00:56:50,549 --> 00:56:48,400
so some right but they don't they don't

1541
00:56:52,870 --> 00:56:50,559
get violated in an experiment why don't

1542
00:56:54,390 --> 00:56:52,880
they get violated by theoreticians of

1543
00:56:55,670 --> 00:56:54,400
course

1544
00:56:57,030 --> 00:56:55,680
right but you don't want to throw away

1545
00:56:59,109 --> 00:56:57,040
all theoreticians because if a

1546
00:57:01,750 --> 00:56:59,119
theoretician will keep themselves

1547
00:57:03,510 --> 00:57:01,760
constrained to the physical world and

1548
00:57:05,510 --> 00:57:03,520
parameters and rules of chemistry they

1549
00:57:08,870 --> 00:57:05,520
might do something you know good and

1550
00:57:11,349 --> 00:57:08,880
show us the way as experimentals right

1551
00:57:13,829 --> 00:57:11,359
that's all right i tell you this i i am

1552
00:57:15,589 --> 00:57:13,839
primarily a theoretician so i'm just

1553
00:57:17,829 --> 00:57:15,599
telling you this

1554
00:57:19,829 --> 00:57:17,839
not uh trying to exclude myself from

1555
00:57:22,870 --> 00:57:19,839
this but uh i mean what's really been

1556
00:57:25,349 --> 00:57:22,880
lacking in this field is a connection to

1557
00:57:27,829 --> 00:57:25,359
the geology is a connection making the

1558
00:57:29,829 --> 00:57:27,839
connection between what organic chemists

1559
00:57:32,710 --> 00:57:29,839
think about in the lab which is rarely

1560
00:57:34,710 --> 00:57:32,720
to use an aqueous medium to what really

1561
00:57:36,710 --> 00:57:34,720
you can what you can actually do in an

1562
00:57:38,230 --> 00:57:36,720
aqueous geological environment i think

1563
00:57:40,470 --> 00:57:38,240

that's something that's been

1564
00:57:41,750 --> 00:57:40,480
sorely lacking in this in this area

1565
00:57:44,870 --> 00:57:41,760
especially when you look at the

1566
00:57:47,109 --> 00:57:44,880
development of function as uh you know

1567
00:57:49,589 --> 00:57:47,119
lauren's initial list that sort of

1568
00:57:51,670 --> 00:57:49,599
progression of complexity i think i i

1569
00:57:52,630 --> 00:57:51,680
don't see anybody doing that and it's i

1570
00:57:56,549 --> 00:57:52,640
think

1571
00:57:58,549 --> 00:57:56,559
should be emphasized

1572
00:58:01,190 --> 00:57:58,559
the notion of a seductive figure is

1573
00:58:03,109 --> 00:58:01,200
something that uh

1574
00:58:04,950 --> 00:58:03,119
this kind of makes seductive figures

1575
00:58:08,710 --> 00:58:04,960
that's true yeah yeah

1576
00:58:15,190 --> 00:58:11,190
at this point and say we're down to our

1577
00:58:17,109 --> 00:58:15,200
last two or three minutes okay

1578
00:58:19,349 --> 00:58:17,119
are there any key points that you want

1579
00:58:21,829 --> 00:58:19,359
to cover in that remaining time i would

1580
00:58:23,990 --> 00:58:21,839
like to at least uh we have one more

1581
00:58:26,150 --> 00:58:24,000
slide let's at least try to get to it

1582
00:58:29,030 --> 00:58:26,160
that would be a good thing to do

1583
00:58:31,670 --> 00:58:29,040
um so this is um

1584
00:58:59,589 --> 00:58:31,680
uh the the next slide maybe just takes i

1585
00:59:03,190 --> 00:59:01,910
okay so i'm going to assume so

1586
00:59:04,630 --> 00:59:03,200
is there anything here that that

1587
00:59:07,910 --> 00:59:04,640
somebody really wants

1588
00:59:11,109 --> 00:59:07,920

uh has a burning opinion about

1589
00:59:14,230 --> 00:59:12,789
okay uh let me just say that it was when

1590
00:59:15,349 --> 00:59:14,240
i read this page that i thought wow we

1591
00:59:17,510 --> 00:59:15,359
really got to think about what does

1592
00:59:18,870 --> 00:59:17,520
function mean

1593
00:59:21,430 --> 00:59:18,880
and

1594
00:59:22,870 --> 00:59:21,440
this

1595
00:59:24,230 --> 00:59:22,880
session has been really good at defining

1596
00:59:25,910 --> 00:59:24,240
that i'm gonna i'm gonna listen to this

1597
00:59:28,150 --> 00:59:25,920
again and and sort of write down some

1598
00:59:30,470 --> 00:59:28,160
notes that we can put in i think we can

1599
00:59:32,950 --> 00:59:30,480
come up with a

1600
00:59:34,390 --> 00:59:32,960
um some kind of uh definition of

1601
00:59:35,829 --> 00:59:34,400
function whether that goes in the final

1602
00:59:37,510 --> 00:59:35,839
document or not i don't know but at

1603
00:59:39,430 --> 00:59:37,520
least it would make me feel good to try

1604
00:59:41,109 --> 00:59:39,440
to write something down

1605
00:59:42,230 --> 00:59:41,119
um

1606
00:59:44,230 --> 00:59:42,240
and then

1607
00:59:46,870 --> 00:59:44,240
i guess the other thing is that

1608
00:59:48,710 --> 00:59:46,880
i want to stress to everybody is that we

1609
00:59:51,829 --> 00:59:48,720
i think nasa does a really good job of

1610
00:59:53,829 --> 00:59:51,839
trying to get everybody involved and um

1611
00:59:55,990 --> 00:59:53,839
this process is really open and

1612
00:59:59,750 --> 00:59:56,000
hopefully all of us can work

1613
01:00:01,430 --> 00:59:59,760

on this and and um have because i mean

1614
01:00:03,829 --> 01:00:01,440
our community here

1615
01:00:05,109 --> 01:00:03,839
needs to be well represented in the

1616
01:00:07,349 --> 01:00:05,119
roadmap

1617
01:00:10,150 --> 01:00:07,359
and we need to do a good job on this

1618
01:00:13,109 --> 01:00:10,160
process in order to have that

1619
01:00:18,870 --> 01:00:16,069
okay thank you can i actually andy just

1620
01:00:20,470 --> 01:00:18,880
wanted to say one quick thing um what i

1621
01:00:22,230 --> 01:00:20,480
was gonna say is there seems to be a lot

1622
01:00:24,549 --> 01:00:22,240
of great discussion that has gone on

1623
01:00:26,870 --> 01:00:24,559
today and it seems like um there there

1624
01:00:29,109 --> 01:00:26,880
are a lot of people who have um some

1625
01:00:31,030 --> 01:00:29,119
great ideas to put into this so

1626
01:00:33,829 --> 01:00:31,040
lauren it's up to you lauren irene other

1627
01:00:36,309 --> 01:00:33,839
authors of this paper um if you guys i

1628
01:00:38,950 --> 01:00:36,319
mean some of the other groups have had

1629
01:00:40,710 --> 01:00:38,960
um independent google hangouts or

1630
01:00:42,789 --> 01:00:40,720
conference calls where they have

1631
01:00:45,349 --> 01:00:42,799
actually you know that you don't have to

1632
01:00:47,349 --> 01:00:45,359
do this all um through the commenting on

1633
01:00:49,349 --> 01:00:47,359
the website on the google docs if you

1634
01:00:51,829 --> 01:00:49,359
want um if you feel like you would

1635
01:00:53,589 --> 01:00:51,839
benefit from you know doing some of this

1636
01:00:55,270 --> 01:00:53,599
offline having a discussion you know

1637
01:00:57,349 --> 01:00:55,280
that you guys want to do

1638
01:00:59,109 --> 01:00:57,359

however and whenever you want

1639
01:01:01,430 --> 01:00:59,119
and then bringing it back together and

1640
01:01:03,430 --> 01:01:01,440
putting it into the white paper um

1641
01:01:05,510 --> 01:01:03,440
that's fine too

1642
01:01:06,309 --> 01:01:05,520
however you guys feel works best for you

1643
01:01:07,510 --> 01:01:06,319
guys

1644
01:01:09,030 --> 01:01:07,520
go for it

1645
01:01:10,470 --> 01:01:09,040
we want to get you know we want to get

1646
01:01:12,549 --> 01:01:10,480
all these great ideas incorporated

1647
01:01:14,069 --> 01:01:12,559
however however that works

1648
01:01:16,230 --> 01:01:14,079
so thanks andy

1649
01:01:18,230 --> 01:01:16,240
can we get a list of all the email

1650
01:01:20,390 --> 01:01:18,240
addresses of everybody who has been

1651
01:01:21,910 --> 01:01:20,400
online here i have most of them i'm

1652
01:01:25,349 --> 01:01:21,920
seeing but i'm not sure i have all of

1653
01:01:29,270 --> 01:01:27,910
maybe the best way for that to be

1654
01:01:30,069 --> 01:01:29,280
actually i don't know you'll have to ask

1655
01:01:32,789 --> 01:01:30,079
mike

1656
01:01:34,150 --> 01:01:32,799
um the host if there's a way to do that

1657
01:01:35,589 --> 01:01:34,160
but one of the best ways you might do

1658
01:01:36,870 --> 01:01:35,599
would be do you want me to type your

1659
01:01:39,030 --> 01:01:36,880
email address or i don't know if you

1660
01:01:41,430 --> 01:01:39,040
have that way to type this into the chat

1661
01:01:43,589 --> 01:01:41,440
and that way anybody who wants to

1662
01:01:45,750 --> 01:01:43,599
um be a part of this group can just

1663
01:01:47,270 --> 01:01:45,760

email you directly

1664
01:01:49,109 --> 01:01:47,280
i was also thinking that anybody that's

1665
01:01:50,950 --> 01:01:49,119
on right now they can type their emails

1666
01:01:53,270 --> 01:01:50,960
into the chat yeah

1667
01:01:54,950 --> 01:01:53,280
right yep that too

1668
01:01:57,190 --> 01:01:54,960
if everybody just did that right now

1669
01:01:58,710 --> 01:01:57,200
then lauren would have that this is i'm

1670
01:02:02,230 --> 01:01:58,720
gonna do that

1671
01:02:04,829 --> 01:02:02,240
yeah um okay so there's mine

1672
01:02:07,270 --> 01:02:04,839
did i get it right yes

1673
01:02:09,670 --> 01:02:07,280
okay yeah that's great then they're all

1674
01:02:12,230 --> 01:02:09,680
showing out what's going on that's great

1675
01:02:15,190 --> 01:02:12,240
there's got a record on there good

1676
01:02:17,030 --> 01:02:15,200
okay so just by way of wrapping up and

1677
01:02:18,630 --> 01:02:17,040
because i know there are several people

1678
01:02:22,230 --> 01:02:18,640
here who haven't been through the

1679
01:02:23,589 --> 01:02:22,240
process of commenting on the document a

1680
01:02:26,230 --> 01:02:23,599
couple of thoughts

1681
01:02:28,789 --> 01:02:26,240
if any of the authors or anyone else

1682
01:02:30,789 --> 01:02:28,799
involved in this would like to organize

1683
01:02:32,789 --> 01:02:30,799
a google hangout or

1684
01:02:33,670 --> 01:02:32,799
some other kind of meeting and they need

1685
01:02:36,549 --> 01:02:33,680
help

1686
01:02:38,470 --> 01:02:36,559
just email us support at no innovation

1687
01:02:40,549 --> 01:02:38,480
if you need any help on that we'll

1688
01:02:42,870 --> 01:02:40,559

gladly help to organize that the

1689
01:02:46,630 --> 01:02:42,880
document itself is now open for

1690
01:02:49,190 --> 01:02:46,640
commenting what we ask you to do is you

1691
01:02:51,430 --> 01:02:49,200
go to the document to add a comment you

1692
01:02:53,430 --> 01:02:51,440
simply highlight the thing you want to

1693
01:02:56,069 --> 01:02:53,440
comment on a right click and you'll find

1694
01:02:58,309 --> 01:02:56,079
you can add a comment it is really

1695
01:03:01,030 --> 01:02:58,319
helpful though if you can log into your

1696
01:03:02,630 --> 01:03:01,040
google account first just so it's got

1697
01:03:05,270 --> 01:03:02,640
your name on it because it makes it

1698
01:03:07,030 --> 01:03:05,280
easier for for people to get back to you

1699
01:03:07,829 --> 01:03:07,040
etc um

1700
01:03:09,589 --> 01:03:07,839
so

1701
01:03:11,589 --> 01:03:09,599
by all means we can help you organize

1702
01:03:14,710 --> 01:03:11,599
other meetings documents open for

1703
01:03:16,309 --> 01:03:14,720
commenting everyone who wanted to looks

1704
01:03:17,270 --> 01:03:16,319
like they have typed in their email

1705
01:03:19,589 --> 01:03:17,280
address

1706
01:03:23,029 --> 01:03:19,599
fantastic thank you very much there's

1707
01:03:24,950 --> 01:03:23,039
another one tomorrow same time um

1708
01:03:26,789 --> 01:03:24,960
please i think it's basically gonna all

1709
01:03:28,630 --> 01:03:26,799
in some ways be a continuation of this

1710
01:03:30,069 --> 01:03:28,640
session maybe

1711
01:03:32,069 --> 01:03:30,079
i guess so i'm not really sure but i

1712
01:03:34,069 --> 01:03:32,079
think it might be

1713
01:03:35,750 --> 01:03:34,079

all right until tomorrow cheering