Panelists

Attendees (9)

- Hosts (1)
  - Mike Toillion
- Presenters (3)
  - Burckhard Seelig
  - David Lomas
  - Uli Muller
- Participants (5)
  - Aaron Burton
  - Irene Chen
  - Lindsay Hays
  - Loren & Nick
  - Mark A Ditzler

Open Chat (Everyone)

everyone! Feel free to post comments/questions here and we will address them throughout the webinar. Thanks!

--------- (12/05/2013 10:57) ---------

Loren & Nick: Hi Mike are we supposed to be hearing anything?

Mike Toillion: Just a friendly reminder to dial into the teleconference below for audio.

Mike Toillion: Yes, Loren, you should be hearing us (through the telecon)

Loren & Nick: Oh yeah

Mike Toillion: For participants: Teleconference Line: 866-692-3158 / Passcode: 9109668#

--------- (12/05/2013 11:03) ---------

Loren & Nick: pretty faint audio

--------- (12/05/2013 11:27) ---------

Mike Toillion: Lines are open, please feel free to contribute.

Teleconference Instructions (Parti...

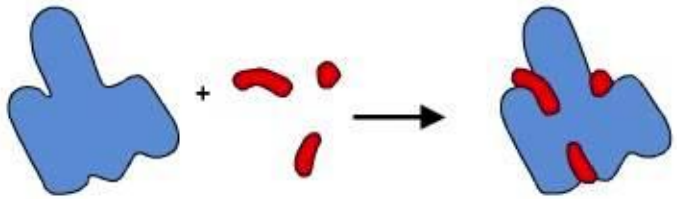
Teleconference Line: 866-692-3158
Passcode: 9109668#
Please use *6 to MUTE your phone's mic when not speaking.
More info: https://astrobiologyfuture.org

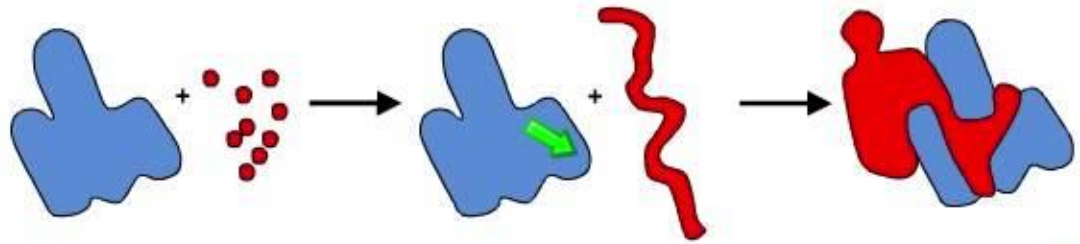
Uli-Burckhard-6f_Presentation.pptx

Full Screen

Sub Question 4:

Did an "RNA world" utilize prebiotically produced peptides, or were functional peptides 'invented' by the RNA world?





U

1
00:00:13,970 --> 00:00:11,209
okay yeah welcome everyone to to the

2
00:00:17,180 --> 00:00:13,980
latest webinar how did peptide meet

3
00:00:18,590 --> 00:00:17,190
nucleotide my name is David Lomas i'm

4
00:00:20,150 --> 00:00:18,600
just going to introduce and then hand

5
00:00:23,540 --> 00:00:20,160
over to our presenters Burkhardt and

6
00:00:25,340 --> 00:00:23,550
only for this evening just so you know

7
00:00:27,290 --> 00:00:25,350
the document that they're presenting is

8
00:00:30,620 --> 00:00:27,300
a google doc and there is a link to it

9
00:00:33,139 --> 00:00:30,630
on the astrobiology future website at

10
00:00:35,120 --> 00:00:33,149
the end of the webinar will change it

11
00:00:36,979 --> 00:00:35,130
around so that anyone can comment on

12
00:00:38,990 --> 00:00:36,989
that document and that's where we'd

13
00:00:41,510 --> 00:00:39,000

invite you to get involved and to

14
00:00:45,139 --> 00:00:41,520
comment and discuss what you hear and

15
00:00:46,549 --> 00:00:45,149
help build the document up also the

16
00:00:48,470 --> 00:00:46,559
slides that have been presented tonight

17
00:00:50,959 --> 00:00:48,480
there's a link to those on the website

18
00:00:53,420 --> 00:00:50,969
as well if you go into the events

19
00:00:55,040 --> 00:00:53,430
section and the event for for the 5th

20
00:00:57,950 --> 00:00:55,050
December you'll find a link then you can

21
00:01:00,490 --> 00:00:57,960
download the PDF also just to remind

22
00:01:02,689 --> 00:01:00,500
everyone the event is being recorded so

23
00:01:04,729 --> 00:01:02,699
when we open it up to questions and

24
00:01:07,280 --> 00:01:04,739
discussion later on anything you say

25
00:01:09,350 --> 00:01:07,290
will be put on the Internet forever for

26
00:01:10,700 --> 00:01:09,360
people to watch and listen to and once

27
00:01:12,590 --> 00:01:10,710
the event is finished we will put a link

28
00:01:15,469 --> 00:01:12,600
on the website as well so you can go

29
00:01:17,929 --> 00:01:15,479
back and listen again so I think that's

30
00:01:19,550 --> 00:01:17,939
pretty much it and Burke I'm really are

31
00:01:20,899 --> 00:01:19,560
going to present first and then we'll

32
00:01:23,539 --> 00:01:20,909
see if there's any questions from

33
00:01:25,609 --> 00:01:23,549
participants and feel free to use the

34
00:01:28,070 --> 00:01:25,619
chat window on connect if you want to

35
00:01:29,719 --> 00:01:28,080
comment or ask questions as we go along

36
00:01:32,030 --> 00:01:29,729
and we'll try and pick those up towards

37
00:01:35,800 --> 00:01:32,040
the end of the presentation I think

38
00:01:39,109 --> 00:01:35,810

that's it so over to you Burkhardt okay

39
00:01:43,520 --> 00:01:39,119
thank you for the intro and welcome

40
00:01:47,580 --> 00:01:43,530
everyone the topic of today's paper is

41
00:01:50,649 --> 00:01:47,590
how did peptide meet new

42
00:01:54,130 --> 00:01:50,659
there was a whole group of people that

43
00:01:57,130 --> 00:01:54,140
actually authored this paper and the

44
00:02:01,209 --> 00:01:57,140
names of those people has seemed down

45
00:02:02,830 --> 00:02:01,219
below here before so we today we will

46
00:02:07,270 --> 00:02:02,840
actually that the purpose of this

47
00:02:09,520 --> 00:02:07,280
meeting is to refresh the memory of the

48
00:02:12,970 --> 00:02:09,530
people that were there and even more so

49
00:02:17,380 --> 00:02:12,980
to welcome additional people to learn

50
00:02:19,630 --> 00:02:17,390
about this paper but we will still stick

51
00:02:21,130 --> 00:02:19,640
more or less to the paper itself and

52
00:02:23,229 --> 00:02:21,140
discuss and gives a little more

53
00:02:27,069 --> 00:02:23,239
background on individual parts of the

54
00:02:33,220 --> 00:02:27,079
paper so those people as I said met at

55
00:02:35,470 --> 00:02:33,230
the roadmap workshop and at the part of

56
00:02:38,500 --> 00:02:35,480
this workshop we came actually up with

57
00:02:41,350 --> 00:02:38,510
this big board here of all those

58
00:02:44,190 --> 00:02:41,360
different subjects that we and that was

59
00:02:48,039 --> 00:02:44,200
the people there at the Wallops Island

60
00:02:49,270 --> 00:02:48,049
dozens of scientists we put up the

61
00:02:52,150 --> 00:02:49,280
topics that we thought would be

62
00:02:55,680 --> 00:02:52,160
interesting to be a research one in the

63
00:02:57,879 --> 00:02:55,690

next ten years there is then someone

64
00:03:01,660 --> 00:02:57,889
went through the work and made a nice

65
00:03:04,539 --> 00:03:01,670
more readable charge eldest which is the

66
00:03:08,020 --> 00:03:04,549
next slide here despite a diagram that

67
00:03:09,610 --> 00:03:08,030
has has all those different topics on it

68
00:03:10,990 --> 00:03:09,620
and you don't need to read any detail

69
00:03:12,610 --> 00:03:11,000
right now I just want to show you the

70
00:03:14,590 --> 00:03:12,620
complexity of all those different topics

71
00:03:19,629 --> 00:03:14,600
that were brought up and considered a

72
00:03:21,690 --> 00:03:19,639
worthwhile studying so forth I want you

73
00:03:24,699 --> 00:03:21,700
to focus more on the on the left here

74
00:03:28,930 --> 00:03:24,709
and that's exactly where today's paper

75
00:03:31,470 --> 00:03:28,940
comes in I highlighted things in red

76
00:03:36,729 --> 00:03:31,480
here so it's the part of the prebiotic

77
00:03:40,720 --> 00:03:36,739
chemistry and those sub topics here are

78
00:03:43,720 --> 00:03:40,730
kind of origin likely historical order

79
00:03:46,270 --> 00:03:43,730
so first you need to have sources of

80
00:03:49,180 --> 00:03:46,280
chemicals they they then have to

81
00:03:52,150 --> 00:03:49,190
form polymers etc and 10 here comes in

82
00:03:55,660 --> 00:03:52,160
today's topic how did the polypeptide

83
00:03:59,830 --> 00:03:55,670
mean for the nucleotide so before we

84
00:04:02,729 --> 00:03:59,840
talk about our paper I want to show how

85
00:04:05,470 --> 00:04:02,739
we think our paper is connected to other

86
00:04:09,880 --> 00:04:05,480
projects at least the ones that are you

87
00:04:13,300 --> 00:04:09,890
on this slide so first the synthesis of

88
00:04:18,069 --> 00:04:13,310

of oligomers and we have had already a

89
00:04:20,770 --> 00:04:18,079
webinar on this then yesterday Irene and

90
00:04:23,830 --> 00:04:20,780
Lauren and Nick presented the paper on

91
00:04:27,159 --> 00:04:23,840
how did maximum molecules gain function

92
00:04:29,680 --> 00:04:27,169
and then today we will see about

93
00:04:31,180 --> 00:04:29,690
peptides and nucleotides but then also

94
00:04:33,730 --> 00:04:31,190
we think that this is very closely

95
00:04:37,330 --> 00:04:33,740
related to the next bigger more complex

96
00:04:40,780 --> 00:04:37,340
step in the whole process of origin of

97
00:04:43,270 --> 00:04:40,790
life which is what did the earliest life

98
00:04:46,480 --> 00:04:43,280
look like and until we know the

99
00:04:48,969 --> 00:04:46,490
laboratory and models of it so this is

100
00:04:53,890 --> 00:04:48,979
my little introduction here and only

101
00:04:57,280 --> 00:04:53,900
will now what do you think about this

102
00:05:01,390 --> 00:04:57,290
particular okay hi and before I go into

103
00:05:04,120 --> 00:05:01,400
the subtopics or the paper itself I want

104
00:05:07,570 --> 00:05:04,130
to mention that the paper that you

105
00:05:10,330 --> 00:05:07,580
currently find on on the google doc is

106
00:05:12,390 --> 00:05:10,340
not yet exactly the same word as we have

107
00:05:16,150 --> 00:05:12,400
here we made a number of changes

108
00:05:18,130 --> 00:05:16,160
together with with some of you and with

109
00:05:20,110 --> 00:05:18,140
that I want to talk about the

110
00:05:22,600 --> 00:05:20,120
explanation so what is the whole topic

111
00:05:24,900 --> 00:05:22,610
about the whole topic is about these two

112
00:05:27,430 --> 00:05:24,910
polymeric systems that have differing

113
00:05:30,400 --> 00:05:27,440

stability and function so different

114
00:05:36,520 --> 00:05:30,410
chemical characteristics and how they

115
00:05:39,820 --> 00:05:36,530
became in turn codependent and the the

116
00:05:43,480 --> 00:05:39,830
two polymers of course are poly poly

117
00:05:47,380 --> 00:05:43,490
peptide and poly nucleotide and in this

118
00:05:51,400 --> 00:05:47,390
explanation here and you see that for

119
00:05:54,339 --> 00:05:51,410
the polypeptides the diverse chemical

120
00:05:57,190 --> 00:05:54,349
alphabet in the form of amino acid chain

121
00:05:59,770 --> 00:05:57,200
and that was linked by a stable peptide

122
00:06:01,780 --> 00:05:59,780
backbone favorite the enhanced readily

123
00:06:06,030 --> 00:06:01,790
the function function so for example you

124
00:06:08,379 --> 00:06:06,040
can imagine that the formation of a

125
00:06:11,230 --> 00:06:08,389
hydrophobic catalytic pocket may be

126
00:06:13,480 --> 00:06:11,240
beneficial under some circumstances and

127
00:06:16,270 --> 00:06:13,490
in contrast for the protein apologize a

128
00:06:19,659 --> 00:06:16,280
small technical alphabet meaning the

129
00:06:22,060 --> 00:06:19,669
nucleobases linked by a self repulsive

130
00:06:24,100 --> 00:06:22,070
backbone meaning the negatively charged

131
00:06:27,820 --> 00:06:24,110
polyphosphate back to translate the

132
00:06:30,700 --> 00:06:27,830
backbone in DNA RNA and they favorite

133
00:06:33,159 --> 00:06:30,710
Information Center and together these

134
00:06:36,640 --> 00:06:33,169
two chemical characteristics made it

135
00:06:39,100 --> 00:06:36,650
possible they have life as we know and

136
00:06:42,700 --> 00:06:39,110
as a little example here just one

137
00:06:45,190 --> 00:06:42,710
peptide 1 ribozyme is an example for the

138
00:06:48,310 --> 00:06:45,200

RNA until you have an RNA protein

139
00:06:51,370 --> 00:06:48,320
article this case rnap to illustrate

140
00:06:54,700 --> 00:06:51,380
what this whole thing is about and and

141
00:06:57,400 --> 00:06:54,710
the the next part of the paper is about

142
00:07:02,050 --> 00:06:57,410
why do we care why is this important to

143
00:07:04,240 --> 00:07:02,060
the study of origins of life and the

144
00:07:09,340 --> 00:07:04,250
reason is that because we know that

145
00:07:11,320 --> 00:07:09,350
extend life expend life relies on the

146
00:07:14,770 --> 00:07:11,330
interactions between proteins and it's

147
00:07:16,719 --> 00:07:14,780
like a tree and this likely or probably

148
00:07:19,719 --> 00:07:16,729
was also true for early life form and

149
00:07:22,270 --> 00:07:19,729
you can think about two different types

150
00:07:24,730 --> 00:07:22,280
of peptides that were involved in these

151
00:07:26,200 --> 00:07:24,740
interactions first of all the peptide

152
00:07:28,630 --> 00:07:26,210
could have been free biotic Lee

153
00:07:30,159 --> 00:07:28,640
generated it may have been very short

154
00:07:33,520 --> 00:07:30,169
peptides they may have had a very

155
00:07:35,020 --> 00:07:33,530
specific amino acid composition and but

156
00:07:37,360 --> 00:07:35,030
they may have been very important in the

157
00:07:41,340 --> 00:07:37,370
earlier ages of life and in contrast

158
00:07:44,020 --> 00:07:41,350
once you had translation originating and

159
00:07:47,469 --> 00:07:44,030
you were able to form much longer

160
00:07:50,620 --> 00:07:47,479
peptide but probably much longer peptide

161
00:07:54,000 --> 00:07:50,630
and probably allowing much more

162
00:07:57,940 --> 00:07:54,010
complicated structures to to arrive and

163
00:08:00,670 --> 00:07:57,950

that's the reason why translation is it

164
00:08:02,860 --> 00:08:00,680
such an invention of translation is such

165
00:08:05,020 --> 00:08:02,870
an important step in the original or in

166
00:08:07,330 --> 00:08:05,030
the early forms of life and therefore a

167
00:08:09,399 --> 00:08:07,340
better understanding of how nucleic

168
00:08:12,370 --> 00:08:09,409
acids and peptides depend on each other

169
00:08:13,600 --> 00:08:12,380
will show some fundamental constraints

170
00:08:17,140 --> 00:08:13,610
on how life

171
00:08:20,469 --> 00:08:17,150
build on these two polymers do you see

172
00:08:23,020 --> 00:08:20,479
an example with short peptides

173
00:08:26,260 --> 00:08:23,030
illustrated at these red dot and this

174
00:08:29,140 --> 00:08:26,270
blue is the RNA you see this RNA

175
00:08:31,510 --> 00:08:29,150
together with a longer more structured

176
00:08:35,139 --> 00:08:31,520
polypeptide that may allow a more

177
00:08:37,600 --> 00:08:35,149
complex function and with that I hand

178
00:08:41,860 --> 00:08:37,610
back to book right so now we will go

179
00:08:45,269 --> 00:08:41,870
through I think 13 different sub

180
00:08:47,199 --> 00:08:45,279
questions that we defined as a group so

181
00:08:49,449 --> 00:08:47,209
individual despair similar to the other

182
00:08:51,759 --> 00:08:49,459
paper and we will just go through them

183
00:08:53,410 --> 00:08:51,769
one by one one slight at a time some

184
00:08:55,569 --> 00:08:53,420
only will present some I will present

185
00:08:59,620 --> 00:08:55,579
and I'll start with the first sub

186
00:09:01,780 --> 00:08:59,630
question here that is reads what is the

187
00:09:04,509 --> 00:09:01,790
origin and the history of the genetic

188
00:09:06,970 --> 00:09:04,519

code so of course now as religious said

189
00:09:09,880 --> 00:09:06,980
that genetic code is at the heart of all

190
00:09:12,930 --> 00:09:09,890
life we know but could a different set

191
00:09:17,019 --> 00:09:12,940
of amino acids and or nucleotides

192
00:09:19,300 --> 00:09:17,029
function as effectively and we know from

193
00:09:21,130 --> 00:09:19,310
numerous different studies even from

194
00:09:24,430 --> 00:09:21,140
numerous different fields of studies

195
00:09:28,030 --> 00:09:24,440
that the current 20 amino acid off of it

196
00:09:31,360 --> 00:09:28,040
is is actually work in progress and is

197
00:09:34,900 --> 00:09:31,370
the result of a long progress so they're

198
00:09:36,759 --> 00:09:34,910
definitely where smaller alphabets and

199
00:09:40,420 --> 00:09:36,769
earlier at earlier stages so some of

200
00:09:44,829 --> 00:09:40,430
those 20 amino acids that we use today

201
00:09:48,420 --> 00:09:44,839
are very essentially are it's agreed

202
00:09:51,250 --> 00:09:48,430
that they had no chance of being there

203
00:09:54,009 --> 00:09:51,260
it's the origin of life because they

204
00:09:57,550 --> 00:09:54,019
were just not stable enough or prebiotic

205
00:09:59,949 --> 00:09:57,560
chemistry would never make them so the

206
00:10:04,509 --> 00:09:59,959
sub question here invites people to

207
00:10:12,950 --> 00:10:04,519
study the origin of end history of the

208
00:10:16,040 --> 00:10:12,960
code the second question is related to

209
00:10:19,130 --> 00:10:16,050
peptides and proteins again and it's the

210
00:10:23,240 --> 00:10:19,140
question is the peptide backbone that we

211
00:10:25,220 --> 00:10:23,250
see today is exceptional in a small set

212
00:10:29,020 --> 00:10:25,230
of highly stabilized secondary

213
00:10:31,310 --> 00:10:29,030

structures we know the beautiful

214
00:10:33,620 --> 00:10:31,320
features of alpha helices and beta

215
00:10:36,260 --> 00:10:33,630
strands and almost all proteins that we

216
00:10:39,860 --> 00:10:36,270
people have studied so far seem to use

217
00:10:41,480 --> 00:10:39,870
those very efficient ways of forming

218
00:10:45,260 --> 00:10:41,490
structures so that works really really

219
00:10:47,510 --> 00:10:45,270
well but is that is that just is that

220
00:10:49,430 --> 00:10:47,520
the best solution ever probably not so

221
00:10:53,710 --> 00:10:49,440
is it a frozen accident then so we

222
00:10:58,150 --> 00:10:53,720
invite people to to study this and maybe

223
00:11:01,240 --> 00:10:58,160
think about alternatives think that I

224
00:11:05,240 --> 00:11:01,250
definitely have no idea but could maybe

225
00:11:09,410 --> 00:11:05,250
provide similar structures and possibly

226
00:11:12,500 --> 00:11:09,420
functions then the third question only

227
00:11:14,300 --> 00:11:12,510
lieutenant and so the third question is

228
00:11:16,580 --> 00:11:14,310
then switching from peptides to the

229
00:11:19,010 --> 00:11:16,590
nucleic acid portion and its address is

230
00:11:21,680 --> 00:11:19,020
asking the question was re the first

231
00:11:23,510 --> 00:11:21,690
genetic polymer or was there a prerna

232
00:11:27,860 --> 00:11:23,520
world and the number of people have

233
00:11:30,590 --> 00:11:27,870
studied those possible different prerna

234
00:11:33,410 --> 00:11:30,600
nucleic acid for example TNA for 30 s

235
00:11:36,200 --> 00:11:33,420
nucleic acid GNA for clitoral nucleic

236
00:11:39,400 --> 00:11:36,210
acid or diverse pianist or peptide

237
00:11:42,290 --> 00:11:39,410
nucleic acid and you can also state this

238
00:11:45,440 --> 00:11:42,300

question more generally and you can say

239
00:11:47,840 --> 00:11:45,450
are the extent biopolymers as RNA and

240
00:11:51,110 --> 00:11:47,850
DNA and protein are they creations of

241
00:11:55,550 --> 00:11:51,120
biology meaning if they were they

242
00:11:57,950 --> 00:11:55,560
invented by in evolving living organism

243
00:12:01,040 --> 00:11:57,960
or were they incorporated in their

244
00:12:03,560 --> 00:12:01,050
current form from a prebiotic chemistry

245
00:12:07,250 --> 00:12:03,570
and then continuously made by biology

246
00:12:09,500 --> 00:12:07,260
and here you see as an example this is

247
00:12:13,430 --> 00:12:09,510
where are any worth the first biopolymer

248
00:12:16,580 --> 00:12:13,440
this is where TNA was the first prerna

249
00:12:18,290 --> 00:12:16,590
world there was an RNA world and here

250
00:12:20,330 --> 00:12:18,300
you have GNA and PNA having the

251
00:12:23,180 --> 00:12:20,340
different pre army world function but

252
00:12:26,750 --> 00:12:23,190
later evolved into the DNA RNA protein

253
00:12:29,540 --> 00:12:26,760
world and with that we come

254
00:12:34,150 --> 00:12:29,550
the sub question number 4 which is

255
00:12:37,400 --> 00:12:34,160
asking 50 did the RNA world utilize

256
00:12:40,010 --> 00:12:37,410
prebiotic we produce peptide so here as

257
00:12:42,470 --> 00:12:40,020
an illustration you see short peptides

258
00:12:45,680 --> 00:12:42,480
for example two three four amino acids

259
00:12:49,700 --> 00:12:45,690
on and they may have been useful for a

260
00:12:54,050 --> 00:12:49,710
catalytic RNA for example an RNA has a

261
00:12:57,200 --> 00:12:54,060
harder time orc and pulley arginine may

262
00:12:59,780 --> 00:12:57,210
not be beautiful for a ribozyme because

263
00:13:01,820 --> 00:12:59,790

the pulley arginine has lots of positive

264
00:13:05,210 --> 00:13:01,830
charges and may help finding third

265
00:13:08,390 --> 00:13:05,220
substrate or it could be that those

266
00:13:11,960 --> 00:13:08,400
peptides that are then used by the RNA

267
00:13:15,710 --> 00:13:11,970
world they were entirely made by the RNA

268
00:13:17,390 --> 00:13:15,720
world themselves invented early on it by

269
00:13:20,060 --> 00:13:17,400
the only world you have these little

270
00:13:22,550 --> 00:13:20,070
dots symbolize amino acid that were then

271
00:13:25,250 --> 00:13:22,560
polymerized into long peptides that

272
00:13:28,130 --> 00:13:25,260
could fold into structures that directly

273
00:13:29,990 --> 00:13:28,140
help these ribosomes so the question is

274
00:13:32,780 --> 00:13:30,000
can we distinguish between these

275
00:13:36,590 --> 00:13:32,790
scenarios were prebiotic peptide

276
00:13:38,630 --> 00:13:36,600
beautiful for ribozymes for work was it

277
00:13:43,400 --> 00:13:38,640
really that the RNA world needed to

278
00:13:48,230 --> 00:13:43,410
invent their own peptides so the next

279
00:13:52,400 --> 00:13:48,240
question and we came up with is can non

280
00:13:53,810 --> 00:13:52,410
encoded peptide replicate and evolve so

281
00:13:58,100 --> 00:13:53,820
that's a little bit related because if

282
00:14:00,500 --> 00:13:58,110
you don't have the system that we see

283
00:14:03,350 --> 00:14:00,510
nowadays next and bail biology would it

284
00:14:05,060 --> 00:14:03,360
still be possible to to replicate and

285
00:14:07,670 --> 00:14:05,070
evolve and I have found a figure here

286
00:14:10,010 --> 00:14:07,680
from some cave from a paper that's that

287
00:14:11,870 --> 00:14:10,020
people have done but that's just one

288
00:14:14,730 --> 00:14:11,880

example I'm sure there are many more

289
00:14:21,810 --> 00:14:14,740
possibilities out there that

290
00:14:25,139 --> 00:14:21,820
study so in sub question 5 we are

291
00:14:27,150 --> 00:14:25,149
starting to look at molecular photos

292
00:14:29,400 --> 00:14:27,160
that we can find an excellent life in

293
00:14:34,350 --> 00:14:29,410
this case we are looking at non-coding

294
00:14:37,110 --> 00:14:34,360
RNA such as ribosomal RNA RNA PTR na ma

295
00:14:40,590 --> 00:14:37,120
nuclear RNA and other and we are asking

296
00:14:43,980 --> 00:14:40,600
did these RNA or ribozyme did they have

297
00:14:47,100 --> 00:14:43,990
a role in early forms of life because we

298
00:14:49,949 --> 00:14:47,110
may be able to extrapolate back and say

299
00:14:53,360 --> 00:14:49,959
something about the army world or early

300
00:15:01,769 --> 00:14:53,370
forms of life by extrapolating back with

301
00:15:05,930 --> 00:15:01,779
the function in question number 7 we're

302
00:15:09,990 --> 00:15:05,940
asking what can existing rna-protein

303
00:15:13,590 --> 00:15:10,000
metals or cofactor interactions tell us

304
00:15:16,680 --> 00:15:13,600
about the history of RNA and protein so

305
00:15:20,480 --> 00:15:16,690
I have shown you just a few examples of

306
00:15:24,060 --> 00:15:20,490
cofactors first of all ATP and NADH

307
00:15:27,180 --> 00:15:24,070
which really any life that we know use

308
00:15:29,940 --> 00:15:27,190
and very very likely both therefore was

309
00:15:33,060 --> 00:15:29,950
very likely there around and functional

310
00:15:35,430 --> 00:15:33,070
in very early forms of life but they

311
00:15:39,090 --> 00:15:35,440
also of course many much more

312
00:15:43,889 --> 00:15:39,100
complicated cofactors that involve metal

313
00:15:45,000 --> 00:15:43,899

ions and small organic compounds and of

314
00:15:48,720 --> 00:15:45,010
course there's a whole field that

315
00:15:53,300 --> 00:15:48,730
studies iron sulfur sulfur clusters and

316
00:15:57,600 --> 00:15:53,310
their importance so when we study what

317
00:16:02,010 --> 00:15:57,610
excellent biology uses today maybe we

318
00:16:03,960 --> 00:16:02,020
can again extrapolate backwards and try

319
00:16:07,340 --> 00:16:03,970
to understand where those may have come

320
00:16:10,110 --> 00:16:07,350
from and how the early versions of it

321
00:16:13,680 --> 00:16:10,120
may have looked like and the following

322
00:16:16,650 --> 00:16:13,690
question is kind of related to this so

323
00:16:20,550 --> 00:16:16,660
the following question 8 is is more a

324
00:16:23,689 --> 00:16:20,560
tough question of the sub question 7 so

325
00:16:26,850 --> 00:16:23,699
it's looking specifically of the

326
00:16:28,510 --> 00:16:26,860
nucleotide cofactors that we have in

327
00:16:30,760 --> 00:16:28,520
today's extent life

328
00:16:35,560 --> 00:16:30,770
form and you all know eighty to eighty

329
00:16:38,320 --> 00:16:35,570
BGT p FM nad nad ph or f ad and the

330
00:16:41,410 --> 00:16:38,330
question or these cofactors have also

331
00:16:44,170 --> 00:16:41,420
been used as one piece of evidence that

332
00:16:48,540 --> 00:16:44,180
there was indeed an RNA world because

333
00:16:50,890 --> 00:16:48,550
many of these units they wouldn't need

334
00:16:52,750 --> 00:16:50,900
nucleotides or nucleotide as the

335
00:16:55,510 --> 00:16:52,760
chemistry they could as well be coupled

336
00:16:59,830 --> 00:16:55,520
to a minute but just the fact that these

337
00:17:01,990 --> 00:16:59,840
molecules but are intrinsic and coupled

338
00:17:04,360 --> 00:17:02,000

to many different processes and extend

339
00:17:06,280 --> 00:17:04,370
life form that they are nucleotide

340
00:17:09,280 --> 00:17:06,290
cofactors and what for example amino

341
00:17:11,410 --> 00:17:09,290
acid cofactor suggested that Arnie was

342
00:17:14,040 --> 00:17:11,420
much more important in an earlier form

343
00:17:17,680 --> 00:17:14,050
of life and maybe that was the reason

344
00:17:21,280 --> 00:17:17,690
why the top question eight was taken out

345
00:17:25,570 --> 00:17:21,290
of and focusing in a little bit more

346
00:17:28,510 --> 00:17:25,580
from sub question seven to find um did

347
00:17:30,220 --> 00:17:28,520
early forms of life that they really use

348
00:17:32,590 --> 00:17:30,230
these nucleotide cofactors and what can

349
00:17:36,550 --> 00:17:32,600
you learn about me metabolism for

350
00:17:40,840 --> 00:17:36,560
example from their possible important in

351
00:17:43,150 --> 00:17:40,850
early forms of life so we know all the

352
00:17:46,150 --> 00:17:43,160
thought it would be worthwhile to study

353
00:17:50,530 --> 00:17:46,160
how the robustness or evolve the ability

354
00:17:53,620 --> 00:17:50,540
of the single polymer world may or may

355
00:17:59,700 --> 00:17:53,630
not differ from a dual polymeric world

356
00:18:03,730 --> 00:17:59,710
um so a turian Terry on a diet I'm not a

357
00:18:06,490 --> 00:18:03,740
specialist in really studying robustness

358
00:18:11,380 --> 00:18:06,500
or involve ability but people do study

359
00:18:16,409 --> 00:18:11,390
evolvability for proteins or for RNA it

360
00:18:18,479 --> 00:18:16,419
was ability for whole duel polymer or

361
00:18:21,960 --> 00:18:18,489
is a little more complex and therefore

362
00:18:25,169 --> 00:18:21,970
also more difficult to study but for

363
00:18:28,190 --> 00:18:25,179

those two factors robustness of the

364
00:18:31,159 --> 00:18:28,200
system but also be able to evolve are

365
00:18:35,759 --> 00:18:31,169
absolutely crucial to make progress in

366
00:18:37,619 --> 00:18:35,769
the history of life and so just like

367
00:18:43,109 --> 00:18:37,629
many of the other questions this is a

368
00:18:45,749 --> 00:18:43,119
very open and broad invitation to people

369
00:18:49,099 --> 00:18:45,759
that that have ideas how to study this

370
00:18:53,519 --> 00:18:49,109
so that the roadmap as a whole is not

371
00:18:55,349 --> 00:18:53,529
meant to be as far as I understand like

372
00:18:58,859 --> 00:18:55,359
a cookbook on what experiments should be

373
00:19:00,509 --> 00:18:58,869
done it's rather a collection of

374
00:19:02,789 --> 00:19:00,519
questions that should be answered and

375
00:19:06,269 --> 00:19:02,799
then people should really be as creative

376
00:19:08,369 --> 00:19:06,279
as possible to come up with their way of

377
00:19:13,200 --> 00:19:08,379
addressing those questions and hopefully

378
00:19:16,129 --> 00:19:13,210
finding some answers and the sub

379
00:19:20,580 --> 00:19:16,139
question 10 may feel a little bit like

380
00:19:22,919 --> 00:19:20,590
sub-questions 678 where we look at small

381
00:19:25,619 --> 00:19:22,929
molecule but in contrast in the sub

382
00:19:29,430 --> 00:19:25,629
question 10 we are looking at covalent

383
00:19:31,919 --> 00:19:29,440
modifications of RNA or protein that may

384
00:19:34,950 --> 00:19:31,929
have helped the function of RNA and

385
00:19:37,340 --> 00:19:34,960
protein and you may know the are any

386
00:19:40,499 --> 00:19:37,350
modification databases or protein

387
00:19:42,769 --> 00:19:40,509
modification databases and you know that

388
00:19:45,629 --> 00:19:42,779

there's more than a hundred different

389
00:19:50,519 --> 00:19:45,639
modification some of them really exotic

390
00:19:53,070 --> 00:19:50,529
and that may have been generated for the

391
00:19:57,060 --> 00:19:53,080
first time during a very early form of

392
00:20:00,060 --> 00:19:57,070
life and so the question is what can we

393
00:20:03,239 --> 00:20:00,070
say about the early form of life by

394
00:20:07,259 --> 00:20:03,249
looking at today's are any modifications

395
00:20:09,659 --> 00:20:07,269
and today's protein modifications how

396
00:20:16,139 --> 00:20:09,669
where they possibly used in early forms

397
00:20:19,109 --> 00:20:16,149
of life so in the question 11 we invite

398
00:20:22,470 --> 00:20:19,119
people to study the origin instruction

399
00:20:25,779 --> 00:20:22,480
assembly of the of a proto right alone

400
00:20:29,769 --> 00:20:25,789
so the question also

401
00:20:33,879 --> 00:20:29,779
can we deduce those properties from the

402
00:20:36,940 --> 00:20:33,889
extant ribosome what is the evolutionary

403
00:20:39,639 --> 00:20:36,950
pathway to the modern ribosome and of

404
00:20:42,849 --> 00:20:39,649
course the modern ribosome was given to

405
00:20:45,609 --> 00:20:42,859
us by those Nobel laureate here but of

406
00:20:47,950 --> 00:20:45,619
course they just just figured out the

407
00:20:50,649 --> 00:20:47,960
structure really it came from something

408
00:20:55,690 --> 00:20:50,659
much much more simple in several labs

409
00:20:59,169 --> 00:20:55,700
are actively studying this already but

410
00:21:02,440 --> 00:20:59,179
I'm sure there are always more ways of

411
00:21:05,469 --> 00:21:02,450
of hacking away at this very very

412
00:21:09,190 --> 00:21:05,479
important centipede question because

413
00:21:13,060 --> 00:21:09,200

really today the ribosome arguably is

414
00:21:15,129 --> 00:21:13,070
where nucleotide and peptide really

415
00:21:18,430 --> 00:21:15,139
needs in excellent life and that's

416
00:21:24,489 --> 00:21:18,440
really the topic of our paper on solo

417
00:21:26,440 --> 00:21:24,499
paper today in sub question 12 and we

418
00:21:29,440 --> 00:21:26,450
are trying to think a little bit broader

419
00:21:31,839 --> 00:21:29,450
so we are always thinking about that

420
00:21:35,320 --> 00:21:31,849
there was a catalytic and genetic

421
00:21:36,999 --> 00:21:35,330
molecule matches are a type of a RNA

422
00:21:39,489 --> 00:21:37,009
world organism or an early world

423
00:21:42,339 --> 00:21:39,499
organism and am fulfilling molecule

424
00:21:46,599 --> 00:21:42,349
forming amphiphilic molecules forming

425
00:21:48,219 --> 00:21:46,609
lipid membrane around and this it makes

426
00:21:50,139 --> 00:21:48,229
a lot of sense to think about it this

427
00:21:54,909 --> 00:21:50,149
way but there may be other possibilities

428
00:21:58,119 --> 00:21:54,919
and so the core question is can we get a

429
00:22:01,359 --> 00:21:58,129
life like which means self-replication

430
00:22:03,879 --> 00:22:01,369
and open-ended Darwinian evolution from

431
00:22:06,009 --> 00:22:03,889
different assemblies maybe just one

432
00:22:08,019 --> 00:22:06,019
polymer maybe they're sweet maybe

433
00:22:10,719 --> 00:22:08,029
there's three or more possibilities

434
00:22:15,070 --> 00:22:10,729
necessary because so far we do not know

435
00:22:18,609 --> 00:22:15,080
whether it is possible to make and self

436
00:22:21,369 --> 00:22:18,619
replicating and evolving organism with

437
00:22:24,460 --> 00:22:21,379
two polymers such as RNA and lipid

438
00:22:27,759 --> 00:22:24,470

vesicles so this is more trying to think

439
00:22:33,700 --> 00:22:27,769
more broadly about the polymers we have

440
00:22:37,570 --> 00:22:33,710
in early organism and for some questions

441
00:22:39,520 --> 00:22:37,580
13 I need to say that were part and I

442
00:22:41,770 --> 00:22:39,530
when we were working on

443
00:22:43,960 --> 00:22:41,780
document we were adding this tough

444
00:22:46,630 --> 00:22:43,970
question because we felt there is a

445
00:22:49,120 --> 00:22:46,640
little bit of a gap in the existing sub

446
00:22:51,790 --> 00:22:49,130
question and the question is in which

447
00:22:54,610 --> 00:22:51,800
free biotic irrelevant conditions can

448
00:22:57,640 --> 00:22:54,620
peptides enhance the function of RNA or

449
00:23:01,270 --> 00:22:57,650
RNA enhance the function f of peptide

450
00:23:04,570 --> 00:23:01,280
and as an illustration down here you may

451
00:23:07,180 --> 00:23:04,580
have RNA molecules that are inefficient

452
00:23:10,210 --> 00:23:07,190
catalyst here for example you have the

453
00:23:12,400 --> 00:23:10,220
catalytic site and the major problem for

454
00:23:14,200 --> 00:23:12,410
this RNA maybe the binding of a

455
00:23:17,080 --> 00:23:14,210
negatively charged small one armor

456
00:23:19,480 --> 00:23:17,090
however when you add the help of his

457
00:23:21,810 --> 00:23:19,490
more positively charged peptide you may

458
00:23:25,000 --> 00:23:21,820
be much more efficient catalyst and

459
00:23:27,220 --> 00:23:25,010
similarly if you are a peptide that can

460
00:23:29,410 --> 00:23:27,230
catalyze a reaction with the catalytic

461
00:23:32,890 --> 00:23:29,420
right here you may have the problem of

462
00:23:35,260 --> 00:23:32,900
finding a stable old and for example a

463
00:23:36,910 --> 00:23:35,270

small RNA molecule may be able to

464
00:23:39,910 --> 00:23:36,920
provide you with the structural

465
00:23:42,160 --> 00:23:39,920
successful that the peptide can assume

466
00:23:44,740 --> 00:23:42,170
the confirmation that's necessary for

467
00:23:48,520 --> 00:23:44,750
efficient a talented so in this f sub

468
00:23:50,680 --> 00:23:48,530
question we are asking can how when can

469
00:23:52,900 --> 00:23:50,690
peptides enhance a function of RNA and

470
00:23:57,820 --> 00:23:52,910
when can RNA enhance the function of

471
00:23:59,650 --> 00:23:57,830
peptide and this sub question also the

472
00:24:02,950 --> 00:23:59,660
South question also really makes another

473
00:24:06,270 --> 00:24:02,960
connection and to people's research that

474
00:24:10,210 --> 00:24:06,280
study relevant conditions on early Earth

475
00:24:13,360 --> 00:24:10,220
and this is really one of the focus

476
00:24:15,940 --> 00:24:13,370
point here of this question that we want

477
00:24:19,150 --> 00:24:15,950
to play really mainly with personally

478
00:24:20,920 --> 00:24:19,160
with the nucleotides and peptide but we

479
00:24:26,290 --> 00:24:20,930
would also like to encourage people to

480
00:24:28,990 --> 00:24:26,300
link this into reasonable scenarios that

481
00:24:33,430 --> 00:24:29,000
that for example geologists or planetary

482
00:24:34,810 --> 00:24:33,440
scientists could come up with and link

483
00:24:35,860 --> 00:24:34,820
those two things together so there's

484
00:24:37,049 --> 00:24:35,870
another link that i haven't actually

485
00:24:39,389 --> 00:24:37,059
pointed out

486
00:24:44,220 --> 00:24:39,399
earlier I'm sure they're more in

487
00:24:45,690 --> 00:24:44,230
mornings than that and with that we're

488
00:24:49,409 --> 00:24:45,700

at the end and we are asking for your

489
00:24:50,970 --> 00:24:49,419
suggestion in discussion on that's the

490
00:24:52,860 --> 00:24:50,980
question of oh god what is your most

491
00:24:57,749 --> 00:24:52,870
valued research question what

492
00:25:00,810 --> 00:24:57,759
investigating in the coming 10 year okay

493
00:25:02,580 --> 00:25:00,820
with thank you thank you thank you early

494
00:25:06,090 --> 00:25:02,590
thank you both out for a for walking us

495
00:25:08,100 --> 00:25:06,100
through that the paper the CM we're

496
00:25:09,419 --> 00:25:08,110
going to open the the phone line up in a

497
00:25:11,129 --> 00:25:09,429
second just in case anyone does have any

498
00:25:15,029 --> 00:25:11,139
questions we've got a few more minutes

499
00:25:17,009 --> 00:25:15,039
but just a reminder as it says there on

500
00:25:19,440 --> 00:25:17,019
the slide go and have a look at the

501
00:25:20,519 --> 00:25:19,450
website there's a addresses in the at

502
00:25:24,720 --> 00:25:20,529
the bottom of the screen there

503
00:25:26,940 --> 00:25:24,730
astrobiology futures.org and the the

504
00:25:28,609 --> 00:25:26,950
paper that burkhard annalia presented

505
00:25:31,109 --> 00:25:28,619
will open that up for commenting

506
00:25:33,210 --> 00:25:31,119
immediately after the webinar and so

507
00:25:36,389 --> 00:25:33,220
you'll be able to open that up and have

508
00:25:38,789 --> 00:25:36,399
a read through and I think earlier did

509
00:25:40,590 --> 00:25:38,799
you say there are a few changes to be

510
00:25:43,769 --> 00:25:40,600
made to that paper to reflect what you

511
00:25:47,489 --> 00:25:43,779
put in the slides here yes and i will

512
00:25:51,509 --> 00:25:47,499
send you this modified paper in minutes

513
00:25:54,210 --> 00:25:51,519

after in the five minutes after the the

514
00:25:57,359 --> 00:25:54,220
presentation here is done with by okay

515
00:26:00,060 --> 00:25:57,369
that's great thanks ollie ok so if mike

516
00:26:01,590 --> 00:26:00,070
if you're able just to join the phone

517
00:26:03,779 --> 00:26:01,600
lines up we'll just see if anybody has

518
00:26:05,279 --> 00:26:03,789
any immediate questions or things they

519
00:26:07,230 --> 00:26:05,289
want to ask well we've got burkhard

520
00:26:18,379 --> 00:26:07,240
anole on the line please do take the

521
00:26:22,320 --> 00:26:18,389
opportunity hello this nikka is that

522
00:26:26,009 --> 00:26:22,330
listen this is a necklace four and a

523
00:26:30,239 --> 00:26:26,019
half a warning Nick mm-hmm go ahead next

524
00:26:35,609 --> 00:26:30,249
Raja tech so I'm i like what you guys

525
00:26:40,499 --> 00:26:35,619
presented I like what you said about the

526
00:26:43,289 --> 00:26:40,509
pre RNAs and then you know even when

527
00:26:46,109 --> 00:26:43,299
you're talking in terms of the

528
00:26:50,039 --> 00:26:46,119
interactions between these biopolymers

529
00:26:50,580 --> 00:26:50,049
unless you said you could have a prerna

530
00:26:53,490 --> 00:26:50,590
that in our

531
00:27:01,710 --> 00:26:53,500
acted with the peptide right so where

532
00:27:07,529 --> 00:27:01,720
you had that I think so that go back

533
00:27:09,510 --> 00:27:07,539
further okay so so right here so I you

534
00:27:13,380 --> 00:27:09,520
know I think that there is this kind of

535
00:27:17,190 --> 00:27:13,390
a multiple levels on which you could

536
00:27:19,080 --> 00:27:17,200
look at this and what you have here I

537
00:27:21,120 --> 00:27:19,090
think it's great that maybe it wasn't

538
00:27:23,070 --> 00:27:21,130

RNA first maybe something before that

539
00:27:27,419 --> 00:27:23,080
but then that also presents the question

540
00:27:29,070 --> 00:27:27,429
that bill if we're peptides really first

541
00:27:32,700 --> 00:27:29,080
in their lineage right might have been

542
00:27:34,710 --> 00:27:32,710
polyesters before them or you know there

543
00:27:39,090 --> 00:27:34,720
might have been you know rasa mates you

544
00:27:42,539 --> 00:27:39,100
know mixtures of lmd amino acids right

545
00:27:45,090 --> 00:27:42,549
so a question that would come up to is

546
00:27:47,430 --> 00:27:45,100
that when we're thinking about these

547
00:27:48,899 --> 00:27:47,440
first interactions you know not to

548
00:27:50,820 --> 00:27:48,909
complicate things that we do have to

549
00:27:52,830 --> 00:27:50,830
keep the Overmind you know maybe the

550
00:27:55,139 --> 00:27:52,840
first nucleic acid like polymers were

551
00:27:57,029 --> 00:27:55,149
interacting with the first episode like

552
00:28:01,200 --> 00:27:57,039
ones that might have been you know

553
00:28:03,299 --> 00:28:01,210
polyesters and i think that's important

554
00:28:05,870 --> 00:28:03,309
of course it doesn't it all superseded

555
00:28:09,779 --> 00:28:05,880
the work to look at you know small

556
00:28:12,630 --> 00:28:09,789
peptides interacting with you know small

557
00:28:15,480 --> 00:28:12,640
rnas and see how their cooperation gets

558
00:28:17,190 --> 00:28:15,490
going but we want to make sure that it's

559
00:28:20,399 --> 00:28:17,200
open that if somebody wants to look at

560
00:28:22,320 --> 00:28:20,409
you know both of say the earlier

561
00:28:24,600 --> 00:28:22,330
versions are there earlier version of

562
00:28:26,940 --> 00:28:24,610
one or the other of these that we should

563
00:28:28,769 --> 00:28:26,950

keep that in mind that these this

564
00:28:30,659 --> 00:28:28,779
cooperation line started quite early

565
00:28:32,310 --> 00:28:30,669
before everything got sorted out into

566
00:28:36,000 --> 00:28:32,320
these you know really nice we find

567
00:28:39,000 --> 00:28:36,010
polymers okay so one thing we could do

568
00:28:43,070 --> 00:28:39,010
for example in this second that pays

569
00:28:46,080 --> 00:28:43,080
more generally could say what can only

570
00:28:50,460 --> 00:28:46,090
polymer or be free really plausible

571
00:28:52,980 --> 00:28:50,470
polymers creations of biology or were

572
00:28:55,500 --> 00:28:52,990
incorporated from three biotic chemistry

573
00:28:57,720 --> 00:28:55,510
do you think that this is working this

574
00:29:01,200 --> 00:28:57,730
would kind of open it up from Arnie DNA

575
00:29:02,820 --> 00:29:01,210
protein to which periodically possible

576
00:29:03,960 --> 00:29:02,830
polymers because when you include

577
00:29:07,830 --> 00:29:03,970
polyesters

578
00:29:09,030 --> 00:29:07,840
and put the other yeah yeah you can do

579
00:29:10,590 --> 00:29:09,040
something like that because you could

580
00:29:14,040 --> 00:29:10,600
also have like you have in your diagram

581
00:29:18,900 --> 00:29:14,050
here where you have something you know

582
00:29:22,950 --> 00:29:18,910
before the peptide right lineage feeding

583
00:29:24,780 --> 00:29:22,960
into that so yeah if the risk of making

584
00:29:27,450 --> 00:29:24,790
it too complicated you can imagine like

585
00:29:30,060 --> 00:29:27,460
a lineage of the nucleic acid and then

586
00:29:31,980 --> 00:29:30,070
below that a lineage of the non-coated

587
00:29:34,110 --> 00:29:31,990
peptides and then some point there

588
00:29:39,030 --> 00:29:34,120

emerging we just don't know at which

589
00:29:41,520 --> 00:29:39,040
point the emerged yet so yeah you might

590
00:29:45,420 --> 00:29:41,530
be able to capture they're just changing

591
00:29:49,920 --> 00:29:45,430
the wording of that or adding a sentence

592
00:29:53,040 --> 00:29:49,930
in there um so we already added the

593
00:29:55,410 --> 00:29:53,050
sentence and I think if we have a third

594
00:29:58,140 --> 00:29:55,420
sentence we are running the baby care of

595
00:30:01,620 --> 00:29:58,150
trying make the sub question to be all

596
00:30:03,750 --> 00:30:01,630
in combating I think there are other

597
00:30:07,470 --> 00:30:03,760
questions that deal with different

598
00:30:09,750 --> 00:30:07,480
annealing with different molecules so it

599
00:30:13,380 --> 00:30:09,760
might be also further ones where you're

600
00:30:15,600 --> 00:30:13,390
talking about baby are the RNA and the

601
00:30:20,820 --> 00:30:15,610
peptides coming together you know

602
00:30:22,590 --> 00:30:20,830
something yeah so fun years if you can

603
00:30:25,020 --> 00:30:22,600
add in there digitar in the world

604
00:30:27,000 --> 00:30:25,030
utilize periodically produce peptides or

605
00:30:30,290 --> 00:30:27,010
were functional peptides admitted by the

606
00:30:37,410 --> 00:30:30,300
RNA world you could expand that a bit or

607
00:30:40,200 --> 00:30:37,420
in RNA world you know use pay an

608
00:30:42,270 --> 00:30:40,210
ancestor of peptides which were later

609
00:30:48,860 --> 00:30:42,280
refined in the peptide something like

610
00:30:52,770 --> 00:30:48,870
that and then fulfill peptides and

611
00:31:00,000 --> 00:30:52,780
consensus with formal 15 it will later

612
00:31:02,550 --> 00:31:00,010
before this define okay but I'm

613
00:31:05,460 --> 00:31:02,560

opposition to the Google document yeah I

614
00:31:07,640 --> 00:31:05,470
really like that suggestion because this

615
00:31:11,090 --> 00:31:07,650
document is supposed to be fighting

616
00:31:12,529 --> 00:31:11,100
people right and not exclude

617
00:31:16,190 --> 00:31:12,539
at all so yeah I really like that

618
00:31:18,470 --> 00:31:16,200
suggestion that's great thanks yeah yeah

619
00:31:20,870 --> 00:31:18,480
I'd agree yeah we want we want to kind

620
00:31:23,419 --> 00:31:20,880
of challenge people right to think you

621
00:31:24,980 --> 00:31:23,429
know about things in and hopefully give

622
00:31:30,430 --> 00:31:24,990
us solutions we hadn't thought of that

623
00:31:36,140 --> 00:31:33,590
brilliant thanks guys um can I see other

624
00:31:37,580 --> 00:31:36,150
any other questions either on a build on

625
00:31:39,770 --> 00:31:37,590
this one or on a completely different

626
00:31:43,159 --> 00:31:39,780
topic anybody else got anything they

627
00:31:45,490 --> 00:31:43,169
want to ask all contribute um can I ask

628
00:31:50,659 --> 00:31:45,500
you a question this is irene brewster

629
00:31:52,820 --> 00:31:50,669
hiring help okay height um I'd run a

630
00:31:55,460 --> 00:31:52,830
little bit late I hope you didn't answer

631
00:31:57,710 --> 00:31:55,470
this question already but I was

632
00:31:59,779 --> 00:31:57,720
wondering if there is a place either

633
00:32:04,370 --> 00:31:59,789
here or maybe in a different document to

634
00:32:07,580 --> 00:32:04,380
consider different to polymer systems

635
00:32:13,120 --> 00:32:07,590
like the DNA RNA possibility as opposed

636
00:32:17,779 --> 00:32:15,380
which gives you pretty well explored

637
00:32:19,340 --> 00:32:17,789
here i wonder if because that i'm

638
00:32:21,760 --> 00:32:19,350

looking at the connections to other

639
00:32:26,180 --> 00:32:21,770
questions I don't think like the sort of

640
00:32:28,250 --> 00:32:26,190
two nucleic acid system is necessarily

641
00:32:29,380 --> 00:32:28,260
explicit in any of the other documents

642
00:32:34,399 --> 00:32:29,390
either i'm just wondering where that

643
00:32:37,340 --> 00:32:34,409
that type of research could go so i

644
00:32:40,340 --> 00:32:37,350
think question 12 is doing a little bit

645
00:32:43,730 --> 00:32:40,350
into this direction but maybe not far

646
00:32:48,140 --> 00:32:43,740
enough the way that you are expressing

647
00:32:50,779 --> 00:32:48,150
here and maybe Picard you've seen war

648
00:32:54,260 --> 00:32:50,789
previous to be not you know other

649
00:32:58,580 --> 00:32:54,270
webinars to go deeper into these

650
00:33:00,529 --> 00:32:58,590
alternatives other polymer system let me

651
00:33:02,480 --> 00:33:00,539
first make sure that I understood was

652
00:33:06,740 --> 00:33:02,490
Irene was suggesting so you wanted to

653
00:33:11,960 --> 00:33:06,750
include an invitation to study the DNA

654
00:33:16,640 --> 00:33:11,970
RNA interaction and ten system right

655
00:33:23,000 --> 00:33:16,650
like I guess I've seen some advocates

656
00:33:24,899 --> 00:33:23,010
for a DNA RNA world preceding the DNA

657
00:33:26,460 --> 00:33:24,909
RNA protein world

658
00:33:29,099 --> 00:33:26,470
I don't know how popular that scenario

659
00:33:32,759 --> 00:33:29,109
is but I just wonder if a two nucleic

660
00:33:37,950 --> 00:33:32,769
acid system might be something we want

661
00:33:41,539 --> 00:33:37,960
to invite and we could also say that at

662
00:33:47,009 --> 00:33:41,549
the point where we say what's there a

663
00:33:49,379 --> 00:33:47,019

prerna world you could just replace one

664
00:33:52,499 --> 00:33:49,389
of these ones with a DNA is that what

665
00:33:55,169 --> 00:33:52,509
you mean that we may have had a DNA in

666
00:33:58,109 --> 00:33:55,179
the pre are any world I mean you are

667
00:33:59,999 --> 00:33:58,119
saying for example based on an annual

668
00:34:01,859 --> 00:34:00,009
list of you I mean that clearly opens

669
00:34:05,869 --> 00:34:01,869
the way for anything else that people

670
00:34:12,210 --> 00:34:09,270
okay maybe I this this is this is Annie

671
00:34:15,629 --> 00:34:12,220
Ellington so I also like Irene was just

672
00:34:16,799 --> 00:34:15,639
able to get on the call um I would only

673
00:34:18,119 --> 00:34:16,809
call yesterday where people were

674
00:34:19,680 --> 00:34:18,129
considering you know sort of the

675
00:34:21,480 --> 00:34:19,690
evolution of function and so maybe this

676
00:34:23,129 --> 00:34:21,490
is meant to be you know far more

677
00:34:24,809 --> 00:34:23,139
delimited towards you know where did the

678
00:34:26,669 --> 00:34:24,819
RNA world come from or something along

679
00:34:28,519 --> 00:34:26,679
those lines but most of what I've been

680
00:34:31,019 --> 00:34:28,529
hearing and seeing so far seems really

681
00:34:33,690 --> 00:34:31,029
constrained like Irene brings up you

682
00:34:36,089 --> 00:34:33,700
know what about DNA sure but there's a

683
00:34:37,079 --> 00:34:36,099
lot more what ifs I mean a lot of what I

684
00:34:38,579 --> 00:34:37,089
you know even as you were flipping

685
00:34:41,159 --> 00:34:38,589
through the slides like okay if we want

686
00:34:42,690 --> 00:34:41,169
to explain this natural world these are

687
00:34:45,389 --> 00:34:42,700
reasonable questions we want to explain

688
00:34:47,549 --> 00:34:45,399

the possibilities of origins and the

689
00:34:49,470 --> 00:34:47,559
possibilities of living systems these

690
00:34:53,970 --> 00:34:49,480
candies questions even the thrust seem

691
00:34:56,700 --> 00:34:53,980
very constrained to me so do you have

692
00:34:59,069 --> 00:34:56,710
specific question in which that you

693
00:35:00,809 --> 00:34:59,079
would think it could be offended or do

694
00:35:06,510 --> 00:35:00,819
you think we should just add another cup

695
00:35:10,160 --> 00:35:06,520
question they talk and Irene or me and I

696
00:35:14,460 --> 00:35:10,170
think and ND you just made it more

697
00:35:15,839 --> 00:35:14,470
generally do yeah so we should yes i was

698
00:35:17,069 --> 00:35:15,849
just i would state i would stayed all of

699
00:35:18,870 --> 00:35:17,079
these some of these questions more

700
00:35:20,640 --> 00:35:18,880
generally you know it's like like was

701
00:35:22,049 --> 00:35:20,650
RNA the first genetic polymer or was

702
00:35:24,240 --> 00:35:22,059
there prerna world i mean that's very

703
00:35:26,609 --> 00:35:24,250
specific even even to begin with what

704
00:35:29,430 --> 00:35:26,619
are the systems by which genetic

705
00:35:31,349 --> 00:35:29,440
polymers may have evolved and may have

706
00:35:32,760 --> 00:35:31,359
transformed there's the general question

707
00:35:34,620 --> 00:35:32,770
the universe of possible genetic

708
00:35:36,480 --> 00:35:34,630
polymers and the universe of

709
00:35:37,800 --> 00:35:36,490
transformation of those genetic polymers

710
00:35:42,270 --> 00:35:37,810
takes into account DNA

711
00:35:44,430 --> 00:35:42,280
na RNA to DNA DNA to GNA whatever but

712
00:35:45,510 --> 00:35:44,440
but it's a more general question that is

713
00:35:51,450 --> 00:35:45,520

restricted to our current understanding

714
00:35:54,000 --> 00:35:51,460
of life on Earth so m1 if we would put

715
00:35:56,430 --> 00:35:54,010
only this very general statement in

716
00:35:58,800 --> 00:35:56,440
there it may be harder to understand it

717
00:36:01,890 --> 00:35:58,810
not in the abstract I'd so I think we

718
00:36:06,870 --> 00:36:01,900
could add very general statement and

719
00:36:11,610 --> 00:36:06,880
then for example they for example in an

720
00:36:15,240 --> 00:36:11,620
RNA prerna rule on your good 50 people

721
00:36:17,400 --> 00:36:15,250
punched you think that's good I to make

722
00:36:20,570 --> 00:36:17,410
it understandable yeah I do like that

723
00:36:24,960 --> 00:36:20,580
suggestion and I very vividly remember

724
00:36:27,470 --> 00:36:24,970
the 10 plus people of us that were the

725
00:36:31,020 --> 00:36:27,480
authors of this paper at Wallops Island

726
00:36:33,570 --> 00:36:31,030
is struggling with us because we had we

727
00:36:36,020 --> 00:36:33,580
most often agreed on a general idea and

728
00:36:39,030 --> 00:36:36,030
that's exactly what any just said

729
00:36:40,830 --> 00:36:39,040
genetic polymers how could they have

730
00:36:43,650 --> 00:36:40,840
interacted what could have proceeded

731
00:36:45,240 --> 00:36:43,660
what but then someone said oh how about

732
00:36:46,830 --> 00:36:45,250
this and then we said okay let's write

733
00:36:49,040 --> 00:36:46,840
it down to and then out someone else's

734
00:36:51,900 --> 00:36:49,050
oh how about that so then we struggle to

735
00:36:54,390 --> 00:36:51,910
get all those different examples in

736
00:36:56,610 --> 00:36:54,400
there but one way out is to just praise

737
00:36:59,190 --> 00:36:56,620
it broadly enough and then maybe give

738
00:37:02,250 --> 00:36:59,200

two three example but examples but make

739
00:37:05,580 --> 00:37:02,260
it make the emphasis on the broad all

740
00:37:09,060 --> 00:37:05,590
inclusive way of phrasing it and I

741
00:37:10,890 --> 00:37:09,070
encourage any to go to actually the very

742
00:37:14,040 --> 00:37:10,900
paper that will be open for comments

743
00:37:17,100 --> 00:37:14,050
again as I understand later today and

744
00:37:19,560 --> 00:37:17,110
just suggest alternatives phrase it

745
00:37:21,450 --> 00:37:19,570
because I think that as far as I can

746
00:37:24,180 --> 00:37:21,460
tell everybody agrees that it should be

747
00:37:27,270 --> 00:37:24,190
general and inviting to two people that

748
00:37:31,470 --> 00:37:27,280
are more creative than one has been out

749
00:37:32,790 --> 00:37:31,480
there yeah and I sorry go ahead our

750
00:37:36,090 --> 00:37:32,800
answer I was just going to say this is

751
00:37:39,510 --> 00:37:36,100
actually Lindsay what is it so I'm

752
00:37:40,950 --> 00:37:39,520
listening to so this I mean you can tell

753
00:37:43,080 --> 00:37:40,960
it with the different sort of the

754
00:37:44,130 --> 00:37:43,090
groupings in the spider diagram that

755
00:37:45,960 --> 00:37:44,140
there's certainly sort of different

756
00:37:48,870 --> 00:37:45,970
communities that are mostly in one

757
00:37:50,670 --> 00:37:48,880
grouping or another and so I don't know

758
00:37:54,150 --> 00:37:50,680
how much you guys have listened to

759
00:37:56,280 --> 00:37:54,160
z the presentations for the the

760
00:37:57,690 --> 00:37:56,290
formation of habitability side of the

761
00:37:59,760 --> 00:37:57,700
spider diagram all the way to the right

762
00:38:03,810 --> 00:37:59,770
but actually one of the things that they

763
00:38:06,150 --> 00:38:03,820

did was they actually combined three

764
00:38:07,920 --> 00:38:06,160
papers and then spit out three different

765
00:38:10,290 --> 00:38:07,930
papers that were related but basically

766
00:38:12,720 --> 00:38:10,300
they sort of had decided that three of

767
00:38:14,850 --> 00:38:12,730
them were not quite worded correctly and

768
00:38:16,170 --> 00:38:14,860
the way the field is done you know they

769
00:38:18,030 --> 00:38:16,180
felt that it would be better if they you

770
00:38:19,080 --> 00:38:18,040
know took a little bit from one and a

771
00:38:21,030 --> 00:38:19,090
little bit from the other a little bit

772
00:38:23,250 --> 00:38:21,040
from the third and made we know three

773
00:38:25,440 --> 00:38:23,260
different papers out of it so if you

774
00:38:26,730 --> 00:38:25,450
guys feel like you know the side that

775
00:38:28,740 --> 00:38:26,740
you know the left side over there the

776
00:38:32,820 --> 00:38:28,750
prebiotic to biotic chemistry isn't

777
00:38:36,330 --> 00:38:32,830
quite divided properly you guys can

778
00:38:38,640 --> 00:38:36,340
definitely you know combine synthesize

779
00:38:41,840 --> 00:38:38,650
and separate out those papers into other

780
00:38:44,250 --> 00:38:41,850
forms if you feel that better represents

781
00:38:45,930 --> 00:38:44,260
the research that's being done and the

782
00:38:48,510 --> 00:38:45,940
research that you guys want to do in the

783
00:38:50,160 --> 00:38:48,520
next ten years actually that's very very

784
00:38:51,540 --> 00:38:50,170
encouraging Wednesday are being relative

785
00:38:53,340 --> 00:38:51,550
to the discussion we had yesterday where

786
00:38:55,950 --> 00:38:53,350
I was worried that folks were getting

787
00:38:58,020 --> 00:38:55,960
too enmeshed in you know sort of their

788
00:38:59,490 --> 00:38:58,030

own directions the notion that you know

789
00:39:01,830 --> 00:38:59,500
there could be that synthesis even at

790
00:39:04,710 --> 00:39:01,840
this level sounds like it's it's very

791
00:39:06,630 --> 00:39:04,720
productive yeah the one the opposite is

792
00:39:08,730 --> 00:39:06,640
the example for the the formation

793
00:39:11,490 --> 00:39:08,740
habitability side was sort of there was

794
00:39:12,780 --> 00:39:11,500
a question about whether or not the

795
00:39:14,670 --> 00:39:12,790
difference for instance the difference

796
00:39:17,220 --> 00:39:14,680
between studying habitable environments

797
00:39:18,690 --> 00:39:17,230
and inhabited environments in our solar

798
00:39:21,330 --> 00:39:18,700
system or two very different things as

799
00:39:23,790 --> 00:39:21,340
opposed to studying either inhabited or

800
00:39:25,440 --> 00:39:23,800
habitable environment outside the solar

801
00:39:26,970 --> 00:39:25,450
system you know that whereas there def

802
00:39:28,860 --> 00:39:26,980
they're definitely sort of four

803
00:39:30,420 --> 00:39:28,870
different topics they're outside of the

804
00:39:33,780 --> 00:39:30,430
solar system we really only have one way

805
00:39:36,030 --> 00:39:33,790
to explore that right now and so that's

806
00:39:37,860 --> 00:39:36,040
certainly like a different topic and

807
00:39:40,800 --> 00:39:37,870
right now I think in the in this spider

808
00:39:43,140 --> 00:39:40,810
diagram we have it separated into so if

809
00:39:45,720 --> 00:39:43,150
you guys feel like you want to combine I

810
00:39:47,490 --> 00:39:45,730
don't know four or five and six or five

811
00:39:49,980 --> 00:39:47,500
and six and sort of separate out how the

812
00:39:51,360 --> 00:39:49,990
topics go you know we can we can we can

813
00:39:54,630 --> 00:39:51,370

facilitate that you guys can definitely

814
00:39:56,730 --> 00:39:54,640
do that yeah and and work hard you know

815
00:39:58,380 --> 00:39:56,740
I've just been busy this termite I

816
00:39:59,760 --> 00:39:58,390
fortunately Lindsay says we have a

817
00:40:01,670 --> 00:39:59,770
chance up through january or so to

818
00:40:03,109 --> 00:40:01,680
comment so I intend to comment people

819
00:40:12,349 --> 00:40:03,119
we'll get sick of my comments quickly as

820
00:40:15,049 --> 00:40:12,359
they usually do so no problem hon do you

821
00:40:18,859 --> 00:40:15,059
think Irene thanks Lindsay any other

822
00:40:21,980 --> 00:40:18,869
comments or questions oh sorry could I

823
00:40:24,710 --> 00:40:21,990
ask a question of Lindsay yeah lindsey

824
00:40:27,260 --> 00:40:24,720
is is the strategy document planned to

825
00:40:28,640 --> 00:40:27,270
be a kind of US Constitution style short

826
00:40:30,589 --> 00:40:28,650
saying where you can kind of interpret

827
00:40:33,380 --> 00:40:30,599
it very broadly and generally or

828
00:40:38,210 --> 00:40:33,390
specifically or is it intended to be

829
00:40:41,359 --> 00:40:38,220
more of a more detailed kind of many

830
00:40:43,940 --> 00:40:41,369
pages more explicit instruction you know

831
00:40:45,680 --> 00:40:43,950
what I mean um well I believe that the

832
00:40:47,390 --> 00:40:45,690
you know I think I think that the

833
00:40:50,000 --> 00:40:47,400
ultimate format is not going to be all

834
00:40:52,370 --> 00:40:50,010
that different than our current roadmap

835
00:40:54,079 --> 00:40:52,380
format so you know not a four-page

836
00:40:57,200 --> 00:40:54,089
document we're not going to take you

837
00:40:58,809 --> 00:40:57,210
know 26 3 page documents and create a

838
00:41:01,370 --> 00:40:58,819

four-page document out of all of them

839
00:41:03,410 --> 00:41:01,380
you know we're not we're not we're not

840
00:41:05,900 --> 00:41:03,420
combining it down that you know we're

841
00:41:07,970 --> 00:41:05,910
not we're not rendering it that much but

842
00:41:11,930 --> 00:41:07,980
it's certainly not it probably won't be

843
00:41:13,220 --> 00:41:11,940
you know 75 pages though either so it's

844
00:41:15,380 --> 00:41:13,230
going to be sort of somewhere in between

845
00:41:17,030 --> 00:41:15,390
we're certainly not going to take you

846
00:41:18,799 --> 00:41:17,040
know we're not going to try and maintain

847
00:41:20,539 --> 00:41:18,809
every word but we're going to try and

848
00:41:21,650 --> 00:41:20,549
maintain you know all of the work that

849
00:41:23,180 --> 00:41:21,660
you guys have been doing and all of the

850
00:41:25,789 --> 00:41:23,190
ideas you guys been bringing up and that

851
00:41:31,970 --> 00:41:25,799
kind of thing okay I see did that answer

852
00:41:38,780 --> 00:41:31,980
your question yes okay thanks Lizzie any

853
00:41:40,520 --> 00:41:38,790
other questions okay I guess if we're

854
00:41:42,650 --> 00:41:40,530
all if we're all done and all happy I

855
00:41:48,170 --> 00:41:42,660
gotta thank you want to go to per carton

856
00:41:49,609 --> 00:41:48,180
early thank you and we'll just what will

857
00:41:51,440 --> 00:41:49,619
I said we were going to open the

858
00:41:53,329 --> 00:41:51,450
document for commenting as soon as the

859
00:41:55,520 --> 00:41:53,339
webinars finished we just want to make

860
00:41:58,099 --> 00:41:55,530
sure that we have got the latest version

861
00:41:59,420 --> 00:41:58,109
of the document there that reflects some

862
00:42:01,880 --> 00:41:59,430
changes early and Burkhardt have made

863
00:42:03,349 --> 00:42:01,890

and so as soon as that's done we'll open

864
00:42:06,530 --> 00:42:03,359
it for commenting the link is on the

865
00:42:09,200 --> 00:42:06,540
website the slide pack that you've

866
00:42:11,839 --> 00:42:09,210
seemed to in the webinar is available on

867
00:42:14,030 --> 00:42:11,849
the website and as soon as we get the

868
00:42:15,410 --> 00:42:14,040
recording the link will be on there as

869
00:42:18,160 --> 00:42:15,420
well so hopefully

870
00:42:21,289 --> 00:42:18,170
find everything you need by the website

871
00:42:25,430 --> 00:42:21,299
okay I have one I have one quick welcome

872
00:42:28,010 --> 00:42:25,440
like um the we had three comments what

873
00:42:29,329 --> 00:42:28,020
we could change about document two of

874
00:42:33,140 --> 00:42:29,339
them were quite specific should i

875
00:42:34,849 --> 00:42:33,150
include these changes or should I should

876
00:42:38,599 --> 00:42:34,859
I just give you the document that what

877
00:42:40,370 --> 00:42:38,609
they were presented here I think you

878
00:42:43,789 --> 00:42:40,380
have some very specific things it'd be

879
00:42:45,380 --> 00:42:43,799
better just to redo the the online

880
00:42:47,839 --> 00:42:45,390
document once so if you can include

881
00:42:49,490 --> 00:42:47,849
those that would be great okay good and

882
00:42:51,049 --> 00:42:49,500
I have to leave in two minutes I will do

883
00:42:53,420 --> 00:42:51,059
it very quickly and send it to you in

884
00:42:56,900 --> 00:42:53,430
the bottom a minute ok no problem thanks