
AbSciCon
2019

1
00:00:00,790 --> 00:00:07,320
[Music]

2
00:00:12,920 --> 00:00:09,730
[Applause]

3
00:00:15,199 --> 00:00:12,930
hello everyone so yes my name is Maureen

4
00:00:19,190 --> 00:00:15,209
Franco Pinter and I'm a NASA

5
00:00:22,339 --> 00:00:19,200
postdoctoral fellow can you hear me okay

6
00:00:24,950 --> 00:00:22,349
working with dr. Williams dr. hood and

7
00:00:26,540 --> 00:00:24,960
dr. Grover at Georgia Tech I'm also a

8
00:00:29,089 --> 00:00:26,550
proud member of the Center for chemical

9
00:00:31,190 --> 00:00:29,099
evolution and the Center for origins of

10
00:00:32,959 --> 00:00:31,200
life at Georgia Tech and today I will

11
00:00:36,790 --> 00:00:32,969
tell you about chemical mutualism

12
00:00:39,410 --> 00:00:36,800
between RNA and cationic lepsy public

13
00:00:41,180 --> 00:00:39,420

but first let's start with a quick

14
00:00:44,840 --> 00:00:41,190
definition of what do you mean by

15
00:00:46,610 --> 00:00:44,850
mutualism I'm sure I'll follow if all of

16
00:00:48,860 --> 00:00:46,620
you are familiar with the definition of

17
00:00:50,450 --> 00:00:48,870
mutualism in biology in which we have

18
00:00:53,510 --> 00:00:50,460
interactions in which both species

19
00:00:56,150 --> 00:00:53,520
benefit in the level of the organisms

20
00:00:57,620 --> 00:00:56,160
for instance we know that the bee

21
00:01:00,740 --> 00:00:57,630
pollinates the flower and the flower

22
00:01:02,889 --> 00:01:00,750
supplies food for the bee and it's the

23
00:01:05,719 --> 00:01:02,899
same thing when we talk about chemical

24
00:01:08,660 --> 00:01:05,729
mutualism in which we have interactions

25
00:01:11,389 --> 00:01:08,670
between species in the form of molecules

26
00:01:15,349 --> 00:01:11,399
in which both types of polymers benefit

27
00:01:17,149 --> 00:01:15,359
here we see this well the most complex

28
00:01:20,270 --> 00:01:17,159
molecular machinery that we know today

29
00:01:23,510 --> 00:01:20,280
the ribosome which is composed of both

30
00:01:26,599 --> 00:01:23,520
RNA and proteins we know that RNA makes

31
00:01:27,830 --> 00:01:26,609
proteins and proteins make RNA and we

32
00:01:29,929 --> 00:01:27,840
think that these types of interactions

33
00:01:31,669 --> 00:01:29,939
between different types of polymers were

34
00:01:35,510 --> 00:01:31,679
really important very early on in

35
00:01:39,980 --> 00:01:35,520
chemical evolution before diving to our

36
00:01:41,539 --> 00:01:39,990
mutualism project when we look at the

37
00:01:44,389 --> 00:01:41,549
formation of peptides on a prebiotic

38
00:01:46,279 --> 00:01:44,399

earth we face several challenges with

39
00:01:49,249 --> 00:01:46,289
condensation of amino acids into

40
00:01:52,330 --> 00:01:49,259
polypeptides the first challenge is

41
00:01:54,379 --> 00:01:52,340
comes from thermodynamics it is unfair

42
00:01:56,330 --> 00:01:54,389
unfavorable thermodynamically

43
00:01:59,449 --> 00:01:56,340
to form the amide bond in aqueous

44
00:02:02,330 --> 00:01:59,459
solutions next we have to kinetic

45
00:02:04,129 --> 00:02:02,340
barriers first to form the amide bonds

46
00:02:07,519 --> 00:02:04,139
it requires high activation energy

47
00:02:08,240 --> 00:02:07,529
barriers and second if we did form a

48
00:02:10,969 --> 00:02:08,250
dipeptide

49
00:02:13,699 --> 00:02:10,979
it can undergo another imitation to form

50
00:02:16,040 --> 00:02:13,709
this cyclic six membered ring which is

51
00:02:19,100 --> 00:02:16,050
called aikido piperazine which is

52
00:02:20,850 --> 00:02:19,110
hydrolytically very stable and so it's

53
00:02:23,760 --> 00:02:20,860
hard to further elongate

54
00:02:26,310 --> 00:02:23,770
polymers that are being formed to

55
00:02:28,500 --> 00:02:26,320
overcome these challenges or to

56
00:02:31,170 --> 00:02:28,510
polymerize peptide several solutions

57
00:02:33,300 --> 00:02:31,180
have been proposed for instance for the

58
00:02:36,060 --> 00:02:33,310
thermodynamic barrier we can simply

59
00:02:38,220 --> 00:02:36,070
shift to dry down reactions in which the

60
00:02:41,070 --> 00:02:38,230
thermodynamic equilibrium is change and

61
00:02:43,650 --> 00:02:41,080
now we can we can favour condensation

62
00:02:46,260 --> 00:02:43,660
dehydration reactions for the two

63
00:02:48,780 --> 00:02:46,270

kinetic barriers shown here we can use

64
00:02:50,790 --> 00:02:48,790
high temperatures but that could also

65
00:02:53,520 --> 00:02:50,800
lead to some decomposition of the amino

66
00:02:55,710 --> 00:02:53,530
acids themselves or we can use high

67
00:02:58,470 --> 00:02:55,720
energy molecules such as activating

68
00:03:01,110 --> 00:02:58,480
amino acids but there is a questionable

69
00:03:04,860 --> 00:03:01,120
a questionable availability of those

70
00:03:06,300 --> 00:03:04,870
molecules on a pre-wrath in the Center

71
00:03:10,530 --> 00:03:06,310
for chemical evolution we've come up

72
00:03:14,670 --> 00:03:10,540
with another solution and briefly as I

73
00:03:17,729 --> 00:03:14,680
mentioned polymerization of amino acids

74
00:03:20,430 --> 00:03:17,739
to form a polypeptide requires a high

75
00:03:22,740 --> 00:03:20,440
energy high activation energy barrier so

76
00:03:26,820 --> 00:03:22,750
a dry down we would need high

77
00:03:29,580 --> 00:03:26,830
temperatures but doctor had suggested to

78
00:03:31,770 --> 00:03:29,590
use these similar building blocks to

79
00:03:34,640 --> 00:03:31,780
amino acids so these are hydroxy acids

80
00:03:36,690 --> 00:03:34,650
which have alcohol instead of diamine

81
00:03:38,820 --> 00:03:36,700
glycolic acid for instance is the

82
00:03:41,610 --> 00:03:38,830
hydroxy acid analogue of glycine and

83
00:03:43,949 --> 00:03:41,620
lactic acid is the hydroxy acid analogue

84
00:03:46,229 --> 00:03:43,959
of alanine and we know that the atraxi

85
00:03:48,270 --> 00:03:46,239
acids were very readily abundant

86
00:03:50,130 --> 00:03:48,280
probably on the prebiotic earth because

87
00:03:52,440 --> 00:03:50,140
we see them in meteorites they come from

88
00:03:55,350 --> 00:03:52,450

the same type of synthesis as the amino

89
00:03:59,250 --> 00:03:55,360
acids and so they are Co localized

90
00:04:03,270 --> 00:03:59,260
together and we know that to form these

91
00:04:05,640 --> 00:04:03,280
polyesters so this step is pretty easy

92
00:04:09,210 --> 00:04:05,650
because it requires lower activation

93
00:04:12,570 --> 00:04:09,220
energy barriers so we can easily form

94
00:04:14,520 --> 00:04:12,580
polyesters but what will happen if we

95
00:04:16,590 --> 00:04:14,530
will mix these two types of building

96
00:04:19,500 --> 00:04:16,600
blocks amino acids and Roxy acids

97
00:04:21,870 --> 00:04:19,510
together so what we see under a dry run

98
00:04:23,640 --> 00:04:21,880
reactions is that we can form the aBSI

99
00:04:27,630 --> 00:04:23,650
peptides which are core polymers of

100
00:04:30,900 --> 00:04:27,640
amino nitrox acids or esters and amides

101
00:04:33,659 --> 00:04:30,910
and the reason why we can form these are

102
00:04:34,439 --> 00:04:33,669
these peptide bonds is through a

103
00:04:37,649 --> 00:04:34,449
mechanism

104
00:04:40,679 --> 00:04:37,659
called estimate exchange once we have

105
00:04:43,950 --> 00:04:40,689
our esters we have an activated carbon

106
00:04:46,829 --> 00:04:43,960
eel that can undergo a nucleophilic and

107
00:04:48,779 --> 00:04:46,839
chlorophyll attack with an amine in a

108
00:04:52,260 --> 00:04:48,789
process called experiment exchange and

109
00:04:56,999 --> 00:04:52,270
now we formed an amide bond and replace

110
00:04:59,640 --> 00:04:57,009
an ester bond so this process is very we

111
00:05:04,170 --> 00:04:59,650
can readily form that's it baptized just

112
00:05:06,869 --> 00:05:04,180
via dry down reactions so for the

113
00:05:08,610 --> 00:05:06,879

mutualism project our hypothesis is in

114
00:05:12,629 --> 00:05:08,620
interactions between different types of

115
00:05:15,779 --> 00:05:12,639
polymers were really important to shape

116
00:05:17,510 --> 00:05:15,789
chemical evolution and we want to in

117
00:05:19,640 --> 00:05:17,520
this project we want to establish that

118
00:05:23,459 --> 00:05:19,650
specifically interactions between

119
00:05:25,110 --> 00:05:23,469
cationic dupsy pathways in RNA we're

120
00:05:26,700 --> 00:05:25,120
really important and allowed them to

121
00:05:29,579 --> 00:05:26,710
mutually interactive promote the

122
00:05:31,769 --> 00:05:29,589
synthesis stability and function as

123
00:05:34,049 --> 00:05:31,779
model interactions we chose

124
00:05:36,450 --> 00:05:34,059
electrostatic interactions so we study

125
00:05:38,790 --> 00:05:36,460
interactions between cationic Li of

126
00:05:42,540 --> 00:05:38,800
between cationic Pepsi peptides and the

127
00:05:45,779 --> 00:05:42,550
negatively charged RNA backbone and we

128
00:05:48,600 --> 00:05:45,789
asked two main questions first we asked

129
00:05:53,149 --> 00:05:48,610
can we form Karianna cropsy peptides on

130
00:05:56,730 --> 00:05:53,159
VA Dryden reactions when we make these

131
00:05:59,459 --> 00:05:56,740
prebiotic environments the second

132
00:06:01,129 --> 00:05:59,469
question was if we did form carry on

133
00:06:05,670 --> 00:06:01,139
except see peptides can they mutually

134
00:06:07,290 --> 00:06:05,680
interact with RNA and promote it and in

135
00:06:09,300 --> 00:06:07,300
a way that will be really interesting to

136
00:06:14,159 --> 00:06:09,310
look at in terms of function structure

137
00:06:16,670 --> 00:06:14,169
and so on for the first question just

138
00:06:20,070 --> 00:06:16,680

for this slide please no photos because

139
00:06:22,679 --> 00:06:20,080
the paper has just been accepted to PNAS

140
00:06:25,350 --> 00:06:22,689
it's under embargo so the first question

141
00:06:29,159 --> 00:06:25,360
can we form cationic deficit better than

142
00:06:31,079 --> 00:06:29,169
prebiotic earth we formed they are will

143
00:06:33,570 --> 00:06:31,089
form deficit baptized via dry down

144
00:06:36,899 --> 00:06:33,580
reactions of hydroxy acids so we have

145
00:06:39,510 --> 00:06:36,909
lactic acid and glycolic acid and we use

146
00:06:41,730 --> 00:06:39,520
six different cationic amino acids three

147
00:06:44,279 --> 00:06:41,740
of them are the proteinaceous amino

148
00:06:46,679 --> 00:06:44,289
acids by that I mean the amino acid the

149
00:06:47,490 --> 00:06:46,689
quraíanic amino acids that are found

150
00:06:49,080 --> 00:06:47,500
today in

151
00:06:52,560 --> 00:06:49,090
proteins and they are incorporated

152
00:06:55,620 --> 00:06:52,570
during translation these are arginine

153
00:06:58,350 --> 00:06:55,630
histidine analyzing the three on the

154
00:07:00,450 --> 00:06:58,360
bottom here are shorter versions of

155
00:07:02,240 --> 00:07:00,460
lysing which have fewer methylene chains

156
00:07:05,400 --> 00:07:02,250
or methylene groups on the side chain

157
00:07:07,800 --> 00:07:05,410
these are only themed to Fordham you

158
00:07:11,460 --> 00:07:07,810
know Peter casted into three diamond or

159
00:07:14,280 --> 00:07:11,470
propionic acid these non proteinaceous

160
00:07:17,370 --> 00:07:14,290
amino acids are considered to be more

161
00:07:19,410 --> 00:07:17,380
prevalent lyrically plausible we find

162
00:07:22,800 --> 00:07:19,420
them in meteorites and in model

163
00:07:26,820 --> 00:07:22,810

prebiotic reactions so what we did in

164
00:07:30,480 --> 00:07:26,830
our experiments we dried down one I'd

165
00:07:32,670 --> 00:07:30,490
Roxie acid with either one of separately

166
00:07:36,390 --> 00:07:32,680
with either one of these different amino

167
00:07:39,470 --> 00:07:36,400
acids and we formed FC peptides now you

168
00:07:43,650 --> 00:07:39,480
can imagine how complex these different

169
00:07:45,690 --> 00:07:43,660
combinations will be because Arkady's

170
00:07:49,220 --> 00:07:45,700
cationic amino acids can link through

171
00:07:52,140 --> 00:07:49,230
different groups for instance when we

172
00:07:55,020 --> 00:07:52,150
dried our glycolic acid with lysing so

173
00:07:56,400 --> 00:07:55,030
license has two amino groups the Alpha

174
00:07:59,000 --> 00:07:56,410
amine and the epsilon Amin

175
00:08:02,640 --> 00:07:59,010
so both of these amines can potentially

176
00:08:04,560 --> 00:08:02,650
react them to form an amide bond we've

177
00:08:08,550 --> 00:08:04,570
characterized the deficit baptized using

178
00:08:11,760 --> 00:08:08,560
a variety of methods including FTIR mass

179
00:08:14,190 --> 00:08:11,770
spec h2 HPLC and so on but the method

180
00:08:16,230 --> 00:08:14,200
that was most informative was NMR and

181
00:08:18,030 --> 00:08:16,240
what it did it allowed us to look at the

182
00:08:20,670 --> 00:08:18,040
collective properties of the in-sample

183
00:08:23,100 --> 00:08:20,680
of molecules or the chemical signature

184
00:08:25,740 --> 00:08:23,110
of the Pepsi peptide that we form and

185
00:08:28,170 --> 00:08:25,750
what we found is very interesting so for

186
00:08:30,420 --> 00:08:28,180
instance in the case of lysing lysine as

187
00:08:33,060 --> 00:08:30,430
I mentioned can emulate just through the

188
00:08:36,510 --> 00:08:33,070

Alpha mean or just through the epsilon

189
00:08:39,270 --> 00:08:36,520
amine or using both the Alpha and the

190
00:08:42,540 --> 00:08:39,280
epsilon I mean what we found by NMR is

191
00:08:45,390 --> 00:08:42,550
that actually most of the polymers that

192
00:08:48,720 --> 00:08:45,400
we formed were worried those in which

193
00:08:51,150 --> 00:08:48,730
lies in a mediator the Alpha amine but

194
00:08:53,520 --> 00:08:51,160
still had a free epsilon amine and we

195
00:08:56,520 --> 00:08:53,530
have a pretty good understanding to why

196
00:08:59,370 --> 00:08:56,530
this is but in the beginning it was

197
00:09:00,720 --> 00:08:59,380
quite very well still it's really

198
00:09:03,030 --> 00:09:00,730
interesting too

199
00:09:05,670 --> 00:09:03,040
so 77 percent of all of our polymers

200
00:09:08,519 --> 00:09:05,680
look like that which implies it's just

201
00:09:11,880 --> 00:09:08,529
like in today's biology where the lysing

202
00:09:13,950 --> 00:09:11,890
will we have these I guess linear

203
00:09:17,880 --> 00:09:13,960
polymers with free amine groups on the

204
00:09:19,829 --> 00:09:17,890
cationic amino acids and hopefully you

205
00:09:22,079 --> 00:09:19,839
can see this work soon but just to

206
00:09:23,670 --> 00:09:22,089
summarize we have seen something very

207
00:09:26,100 --> 00:09:23,680
interesting is that the proteinaceous

208
00:09:28,140 --> 00:09:26,110
amino acids condense more extensively

209
00:09:30,240 --> 00:09:28,150
and selectively through their alpha mean

210
00:09:32,850 --> 00:09:30,250
compared to the non proteinaceous amino

211
00:09:35,010 --> 00:09:32,860
acids and we think that we understand

212
00:09:38,430 --> 00:09:35,020
now the chemical basis for selection of

213
00:09:40,200 --> 00:09:38,440

today's cationic amino acids over non

214
00:09:46,019 --> 00:09:40,210
proteinaceous amino acids that we also

215
00:09:48,120 --> 00:09:46,029
had in our soup so yes we can form

216
00:09:50,640 --> 00:09:48,130
cationic Pepsi peptides but what can we

217
00:09:53,970 --> 00:09:50,650
do with them can they take part in a

218
00:09:57,360 --> 00:09:53,980
mutualistic manner with our name so to

219
00:10:01,050 --> 00:09:57,370
that and dr. Lehman synthesized a

220
00:10:04,110 --> 00:10:01,060
cationic Pepsi peptide or a peptide and

221
00:10:07,699 --> 00:10:04,120
we had in our system both labeled RNA

222
00:10:10,199 --> 00:10:07,709
this was a u xx and a family both

223
00:10:12,030 --> 00:10:10,209
peptide or dab sleep at that and the

224
00:10:13,980 --> 00:10:12,040
first thing that we wanted to do is can

225
00:10:16,260 --> 00:10:13,990
we see physical association between the

226
00:10:20,190 --> 00:10:16,270
two types of polymers so we use the

227
00:10:22,829 --> 00:10:20,200
commonly used been shift a saying very

228
00:10:25,050 --> 00:10:22,839
briefly under native gel conditions when

229
00:10:27,690 --> 00:10:25,060
we run our na it will migrate to a

230
00:10:30,210 --> 00:10:27,700
certain extent but upon interaction for

231
00:10:31,920 --> 00:10:30,220
instance with a peptide it will Margaret

232
00:10:34,710 --> 00:10:31,930
a bit slowly and we should be able to

233
00:10:36,360 --> 00:10:34,720
man to look at that so what you can see

234
00:10:38,250 --> 00:10:36,370
here is a indeed where physical

235
00:10:41,370 --> 00:10:38,260
association between peptides and the

236
00:10:45,269 --> 00:10:41,380
cationic baptized and FC peptides the

237
00:10:47,550 --> 00:10:45,279
unbound RNA is labeled in red and we can

238
00:10:50,400 --> 00:10:47,560

see this smear and even the distinct

239
00:10:54,660 --> 00:10:50,410
band in orange that implies the

240
00:10:59,040 --> 00:10:54,670
colocalization of both the RNA and the

241
00:11:01,560 --> 00:10:59,050
peptide or dab see better once we've had

242
00:11:04,350 --> 00:11:01,570
this physical association we went to

243
00:11:06,780 --> 00:11:04,360
explore different ways or means in which

244
00:11:09,569 --> 00:11:06,790
we can look at the mutualism between the

245
00:11:11,940 --> 00:11:09,579
RNA and cationic CC peptides both

246
00:11:13,140 --> 00:11:11,950
synthesized FC peptides but also the

247
00:11:16,079 --> 00:11:13,150
ones is reformed

248
00:11:19,829 --> 00:11:16,089
dried-on reactions what we see here is

249
00:11:21,810 --> 00:11:19,839
one example of such a mutualism aspect

250
00:11:25,460 --> 00:11:21,820
that we saw which is really the most

251
00:11:27,540 --> 00:11:25,470
fundamental element of mutualism if

252
00:11:29,550 --> 00:11:27,550
interactions between different types of

253
00:11:32,820 --> 00:11:29,560
polymers if we have these interactions

254
00:11:35,790 --> 00:11:32,830
this should lead to a slower degradation

255
00:11:38,430 --> 00:11:35,800
rate of the polymers compared to if they

256
00:11:42,030 --> 00:11:38,440
are not associated and this is what we

257
00:11:45,990 --> 00:11:42,040
see here so we have our cationic Pepsi

258
00:11:47,880 --> 00:11:46,000
peptide with just one ester we can

259
00:11:50,190 --> 00:11:47,890
follow the degradation of this Esther

260
00:11:53,910 --> 00:11:50,200
because Esther is degrade much faster

261
00:11:55,980 --> 00:11:53,920
compared to Edmund bonds so looking at

262
00:11:58,470 --> 00:11:55,990
this HPLC chromatogram this here you can

263
00:12:01,470 --> 00:11:58,480

see the degradation of this dubsy

264
00:12:04,410 --> 00:12:01,480
peptide from one minute to 180 minutes

265
00:12:07,620 --> 00:12:04,420
the new peak that arises here is the

266
00:12:10,079 --> 00:12:07,630
segregate degraded deputy peptides so

267
00:12:12,690 --> 00:12:10,089
you can see the degradation this is

268
00:12:15,720 --> 00:12:12,700
without RNA once we introduce RNA to the

269
00:12:18,360 --> 00:12:15,730
sorry to the system you can see Arbus

270
00:12:21,210 --> 00:12:18,370
difference in the degradation rate so we

271
00:12:24,180 --> 00:12:21,220
introduce a tenma RNA duplex and you can

272
00:12:27,210 --> 00:12:24,190
see that there is barely degradation of

273
00:12:30,300 --> 00:12:27,220
that starting the app c-peptide when we

274
00:12:32,160 --> 00:12:30,310
go and quantify these differences here

275
00:12:33,620 --> 00:12:32,170
you can see the percentage of the intact

276
00:12:37,019 --> 00:12:33,630
dep c-peptide

277
00:12:40,140 --> 00:12:37,029
versus time and you can see in black

278
00:12:42,750 --> 00:12:40,150
without RNA in blue with RNA we can see

279
00:12:45,300 --> 00:12:42,760
that RNA duplex increases the the ab c--

280
00:12:47,970 --> 00:12:45,310
peptide half-life by about 30 fold so

281
00:12:54,060 --> 00:12:47,980
this is busting through robust

282
00:12:55,530 --> 00:12:54,070
protection to conclude we have seen that

283
00:12:57,600 --> 00:12:55,540
carry on who have shown that carry on

284
00:13:00,750 --> 00:12:57,610
adapt CPAP des can be formed via dry

285
00:13:04,079 --> 00:13:00,760
down reactions very robustly selectively

286
00:13:05,970 --> 00:13:04,089
and it was great to see that in addition

287
00:13:07,980 --> 00:13:05,980
with I've shown you that irony protects

288
00:13:10,380 --> 00:13:07,990

the esters within cationic Dempsey

289
00:13:13,920 --> 00:13:10,390
peptides and we go about and look at the

290
00:13:16,320 --> 00:13:13,930
different mutualism to Quincy and one

291
00:13:18,600 --> 00:13:16,330
more example that we saw is that I

292
00:13:20,370 --> 00:13:18,610
didn't show you is that cationic lipids

293
00:13:22,770 --> 00:13:20,380
can increase the thermal stability of

294
00:13:25,110 --> 00:13:22,780
our name and overall these findings

295
00:13:25,740 --> 00:13:25,120
suggested indeed cationic the cpap dates

296
00:13:27,870 --> 00:13:25,750
in our name

297
00:13:29,850 --> 00:13:27,880
interact to promote each other a

298
00:13:32,580 --> 00:13:29,860
structure and function they protect each

299
00:13:35,550 --> 00:13:32,590
other and the takeaway message from this

300
00:13:37,380 --> 00:13:35,560
lecture is that we think that yes

301
00:13:40,020 --> 00:13:37,390
interactions between different types of

302
00:13:42,060 --> 00:13:40,030
polymers was very very important in

303
00:13:44,130 --> 00:13:42,070
shaping chemical evolution because

304
00:13:48,110 --> 00:13:44,140
together they are going to be more

305
00:13:52,680 --> 00:13:48,120
stable and thus they will be selected

306
00:13:56,430 --> 00:13:52,690
further on and lastly I would like to

307
00:14:00,770 --> 00:13:56,440
think the Piz I worked with dr. Williams

308
00:14:03,450 --> 00:14:00,780
dr. huh dr. Grover our research groups

309
00:14:06,330 --> 00:14:03,460
here listed all of the co-authors so

310
00:14:09,110 --> 00:14:06,340
you're a team of researchers who work on

311
00:14:11,760 --> 00:14:09,120
this this project that I showed you

312
00:14:14,970 --> 00:14:11,770
specifically the leaders of this project

313
00:14:17,640 --> 00:14:14,980

are dr. Williams and dr. Weiman J

314
00:14:20,490 --> 00:14:17,650
heinous did the gel shift assay that I

315
00:14:23,460 --> 00:14:20,500
showed you Martin C helped with the NMR

316
00:14:25,470 --> 00:14:23,470
analysis dr. Lehmann synthesized

317
00:14:28,440 --> 00:14:25,480
cationic Pepsi peptides and looked at

318
00:14:30,840 --> 00:14:28,450
the degradation I say that I showed you

319
00:14:33,660 --> 00:14:30,850
of the deficit baptized and I would also

320
00:14:36,900 --> 00:14:33,670
like to thank the funding agency NASA

321
00:14:41,070 --> 00:14:36,910
postdoctoral program for funding me and

322
00:14:43,140 --> 00:14:41,080
also NSF NASA for their various grants

323
00:14:51,350 --> 00:14:43,150
and centers that they allow us to be at

324
00:15:08,410 --> 00:14:53,370
all right we have time for one quick

325
00:15:15,290 --> 00:15:12,860
hmm yes so potentially there there could

326
00:15:19,220 --> 00:15:15,300
be such Association I mean such an

327
00:15:21,470 --> 00:15:19,230
effect we also looked at the Association

328
00:15:24,140 --> 00:15:21,480
not through these labeled peptides and

329
00:15:27,019 --> 00:15:24,150
FC peptide I showed but also using just

330
00:15:29,060 --> 00:15:27,029
the labeled RNA and we still saw these

331
00:15:31,790 --> 00:15:29,070
smears just we couldn't see the

332
00:15:34,130 --> 00:15:31,800
colocalization but yeah I mean there

333
00:15:39,410 --> 00:15:34,140
could be some effect but it's not just

334
00:15:41,420 --> 00:15:39,420
30 the floor for all right I think we're