



ABSciCON 2017

MESA, ARIZONA

1
00:00:12,250 --> 00:00:06,150

you

2
00:00:17,260 --> 00:00:14,190

[Music]

3
00:00:19,030 --> 00:00:17,270

this session will inform our community

4
00:00:20,260 --> 00:00:19,040

about historic and current efforts to

5
00:00:21,850 --> 00:00:20,270

address the social cultural

6
00:00:23,980 --> 00:00:21,860

philosophical ethical and other

7
00:00:29,800 --> 00:00:23,990

conceptual issues in the field of

8
00:00:32,290 --> 00:00:29,810

astrobiology we have three pairs of

9
00:00:34,570 --> 00:00:32,300

speakers each pair featuring a natural

10
00:00:36,640 --> 00:00:34,580

scientist and a humanistic scholar each

11
00:00:38,410 --> 00:00:36,650

pair will engage in a 10-minute dialogue

12
00:00:40,540 --> 00:00:38,420

about a question or topic they've chosen

13
00:00:42,670 --> 00:00:40,550

and plenty of time will be allotted

14

00:00:45,430 --> 00:00:42,680

afterwards for dialogue amongst the

15

00:00:46,900 --> 00:00:45,440

speakers and with all of you Lucas is

16

00:00:48,760 --> 00:00:46,910

going to moderate discussion and he's

17

00:00:53,880 --> 00:00:48,770

also going to come up here after I'm

18

00:00:56,290 --> 00:00:53,890

finished and introduce our speakers and

19

00:00:57,670 --> 00:00:56,300

we encourage you to continue the

20

00:00:58,470 --> 00:00:57,680

dialogue throughout the rest of the

21

00:01:00,580 --> 00:00:58,480

conference

22

00:01:02,170 --> 00:01:00,590

so I'm going to talk just a little bit

23

00:01:03,639 --> 00:01:02,180

about historical efforts to address

24

00:01:05,920 --> 00:01:03,649

social and conceptual issues in

25

00:01:09,460 --> 00:01:05,930

astrobiology and also current initial

26
00:01:11,740 --> 00:01:09,470
initial supported by the NASA program to

27
00:01:14,410 --> 00:01:11,750
date efforts to address what what has

28
00:01:16,630 --> 00:01:14,420
been called so far societal impacts of

29
00:01:18,670 --> 00:01:16,640
astrobiology have been sparse sporadic

30
00:01:20,950 --> 00:01:18,680
and disconnected these efforts have been

31
00:01:22,719 --> 00:01:20,960
initiated largely by natural scientists

32
00:01:24,280 --> 00:01:22,729
and the records of these efforts show

33
00:01:26,620 --> 00:01:24,290
that they have been largely constrained

34
00:01:29,560 --> 00:01:26,630
by the scientific worldview what I would

35
00:01:31,510 --> 00:01:29,570
call scientific sinking they've also

36
00:01:33,070 --> 00:01:31,520
been largely Western centric and I would

37
00:01:34,960 --> 00:01:33,080
even argue us-centric

38
00:01:37,929 --> 00:01:34,970

and much of the effort has been set

39

00:01:39,640 --> 00:01:37,939

eccentric but astrobiology today is a

40

00:01:41,020 --> 00:01:39,650

global endeavor focused on the search

41

00:01:43,569 --> 00:01:41,030

for evidence of past or present

42

00:01:45,490 --> 00:01:43,579

microbial life in the solar system and

43

00:01:47,980 --> 00:01:45,500

the possibility of life and exoplanet

44

00:01:51,069 --> 00:01:47,990

systems and discussion of the issues at

45

00:01:53,710 --> 00:01:51,079

hand today needs to broaden and focus

46

00:01:55,660 --> 00:01:53,720

accordingly and in my work I like to

47

00:01:58,120 --> 00:01:55,670

think about astrobiology and culture

48

00:02:00,670 --> 00:01:58,130

what does astrobiology do and mean in

49

00:02:02,620 --> 00:02:00,680

the context of culture what does it do

50

00:02:05,260 --> 00:02:02,630

or mean for people in different cultures

51
00:02:06,789 --> 00:02:05,270
people with different worldviews the

52
00:02:08,289 --> 00:02:06,799
earliest record I found of a NASA

53
00:02:10,359 --> 00:02:08,299
activity that pulled together a

54
00:02:12,160 --> 00:02:10,369
multidisciplinary group of scholars to

55
00:02:14,470 --> 00:02:12,170
address the social philosophic and

56
00:02:16,750 --> 00:02:14,480
humanistic impact of the discovery of

57
00:02:18,940 --> 00:02:16,760
extraterrestrial life is a report called

58
00:02:21,180 --> 00:02:18,950
life beyond Earth in the mind of man and

59
00:02:23,850 --> 00:02:21,190
it's a transcript of a NASA sponsored

60
00:02:26,230 --> 00:02:23,860
symposium that was held in Boston in

61
00:02:28,510 --> 00:02:26,240
1972 to address the question

62
00:02:30,910 --> 00:02:28,520
how much human beings react to the

63
00:02:32,710 --> 00:02:30,920

discovery of life beyond Earth and the

64

00:02:35,260 --> 00:02:32,720

participants in this symposium were

65

00:02:38,140 --> 00:02:35,270

Ashley Montagu and anthropologist Philip

66

00:02:40,420 --> 00:02:38,150

Morrison physicists Carl Sagan Krister

67

00:02:43,720 --> 00:02:40,430

spend all seojin and George Wald

68

00:02:45,610 --> 00:02:43,730

biologists then we fast-forward all the

69

00:02:47,440 --> 00:02:45,620

way up to the late 1990s when the

70

00:02:51,160 --> 00:02:47,450

astrobiology program really began to

71

00:02:54,010 --> 00:02:51,170

expand and the community as well the

72

00:02:58,090 --> 00:02:54,020

NASA astrobiology program toward the

73

00:02:59,710 --> 00:02:58,100

late 1990s early 2000s got involved with

74

00:03:01,480 --> 00:02:59,720

the American Association for the

75

00:03:03,060 --> 00:03:01,490

Advancement of Sciences dialogue and

76

00:03:05,080 --> 00:03:03,070

science ethics and religion and

77

00:03:07,210 --> 00:03:05,090

co-sponsored a series of workshops

78

00:03:09,190 --> 00:03:07,220

organized by douceur on the

79

00:03:11,230 --> 00:03:09,200

philosophical ethical and theological

80

00:03:15,010 --> 00:03:11,240

implications of astrobiology those

81

00:03:18,340 --> 00:03:15,020

workshops were held in 2003 2004 and a

82

00:03:19,930 --> 00:03:18,350

report was published in 1999 a workshop

83

00:03:22,270 --> 00:03:19,940

on the societal implications of

84

00:03:23,170 --> 00:03:22,280

astrobiology was held at the NASA Ames

85

00:03:25,570 --> 00:03:23,180

Research Center

86

00:03:27,610 --> 00:03:25,580

I don't think headquarters was involved

87

00:03:30,280 --> 00:03:27,620

in that and that workshop was organized

88

00:03:32,290 --> 00:03:30,290

to address implications of astrobiology

89

00:03:34,330 --> 00:03:32,300

for human psychology society and culture

90

00:03:36,850 --> 00:03:34,340

and the contributions that the social

91

00:03:38,440 --> 00:03:36,860

sciences can make to the field and there

92

00:03:41,380 --> 00:03:38,450

is a report available on that workshop

93

00:03:44,020 --> 00:03:41,390

in 2009 the SETI Institute in California

94

00:03:46,980 --> 00:03:44,030

held a workshop to develop a roadmap of

95

00:03:48,880 --> 00:03:46,990

societal issues relating to astrobiology

96

00:03:51,070 --> 00:03:48,890

participants in the workshop which

97

00:03:52,780 --> 00:03:51,080

included myself agreed that the product

98

00:03:54,850 --> 00:03:52,790

of the workshop would not be a roadmap

99

00:03:57,160 --> 00:03:54,860

for the astrobiology program or

100

00:03:58,630 --> 00:03:57,170

community but a roadmap of issues for

101

00:04:01,420 --> 00:03:58,640

interested members of the social

102

00:04:03,130 --> 00:04:01,430

sciences and humanities a paper was

103

00:04:05,530 --> 00:04:03,140

published in astrobiology with this

104

00:04:08,200 --> 00:04:05,540

roadmap and that workshop was funded by

105

00:04:12,010 --> 00:04:08,210

the the NASA Astrobiology Institute not

106

00:04:13,810 --> 00:04:12,020

the headquarters program the NASA

107

00:04:16,720 --> 00:04:13,820

Astrobiology community published its

108

00:04:19,960 --> 00:04:16,730

first science roadmap in 1998 and we had

109

00:04:24,070 --> 00:04:19,970

updated roadmaps in 2003 in 2008 and

110

00:04:26,620 --> 00:04:24,080

then in 2015 we have the next iteration

111

00:04:28,990 --> 00:04:26,630

the NASA Astrobiology strategy which

112

00:04:30,910 --> 00:04:29,000

does not identify specific goals

113

00:04:33,040 --> 00:04:30,920

objections and questions relating to

114

00:04:34,980 --> 00:04:33,050

social and cultural issues but it does

115

00:04:38,140 --> 00:04:34,990

include really a very interesting

116

00:04:39,460 --> 00:04:38,150

appendix written by Lucas mix and Connie

117

00:04:43,390 --> 00:04:39,470

Burtka who's not here

118

00:04:46,660 --> 00:04:43,400

of us today and some of the topics that

119

00:04:49,030 --> 00:04:46,670

they raise as issues that we might want

120

00:04:52,590 --> 00:04:49,040

to think about and work on the role of

121

00:04:54,880 --> 00:04:52,600

epistemology is Tamala G in astrobiology

122

00:04:57,100 --> 00:04:54,890

what are the comparative standards of

123

00:04:59,170 --> 00:04:57,110

evidence in astrobiology related fields

124

00:05:00,850 --> 00:04:59,180

it's a definition of life necessary to

125

00:05:02,890 --> 00:05:00,860

the pursuit of estor biology so that's

126

00:05:04,450 --> 00:05:02,900

kind of an example and that strategy is

127

00:05:05,890 --> 00:05:04,460

available online so you can read the

128

00:05:07,950 --> 00:05:05,900

whole appendix which I would recommend

129

00:05:09,850 --> 00:05:07,960

if you're interested in a subject

130

00:05:12,430 --> 00:05:09,860

coincident with the development of this

131

00:05:14,820 --> 00:05:12,440

strategy NASA Astrobiology led at this

132

00:05:16,900 --> 00:05:14,830

point by Mary Wojtek who's with us today

133

00:05:19,150 --> 00:05:16,910

initiated a number of activities

134

00:05:21,220 --> 00:05:19,160

intended to broaden and diversify the

135

00:05:24,160 --> 00:05:21,230

community of scholars participating in

136

00:05:25,900 --> 00:05:24,170

the ongoing dialogue and to refocus this

137

00:05:28,150 --> 00:05:25,910

dialogue on the possible cultural

138

00:05:31,060 --> 00:05:28,160

impacts of discovery of extraterrestrial

139

00:05:33,310 --> 00:05:31,070

microbial life the scope of NASA's

140

00:05:35,980 --> 00:05:33,320

activities is specified by law the NASA

141

00:05:38,080 --> 00:05:35,990

act of 58 and these activities do not

142

00:05:40,930 --> 00:05:38,090

include an ongoing program of research

143

00:05:42,700 --> 00:05:40,940

into these kinds of issues however the

144

00:05:44,860 --> 00:05:42,710

law does include language allowing NASA

145

00:05:47,770 --> 00:05:44,870

to study the effects or implications of

146

00:05:50,320 --> 00:05:47,780

the work that it does so astrobiology

147

00:05:52,750 --> 00:05:50,330

funding for recent activities is

148

00:05:54,190 --> 00:05:52,760

intended as seed funding to provide

149

00:05:56,790 --> 00:05:54,200

opportunities for broader participation

150

00:06:00,520 --> 00:05:56,800

by scholars from multiple disciplines

151
00:06:02,860 --> 00:06:00,530
three activities that are have been

152
00:06:04,659 --> 00:06:02,870
ongoing over the past three to five

153
00:06:06,250 --> 00:06:04,669
years and some of them are wrapping up

154
00:06:08,590 --> 00:06:06,260
because again this is a short-term

155
00:06:11,350 --> 00:06:08,600
project except for one hour the

156
00:06:12,310 --> 00:06:11,360
slumber'd NASA Library of Congress Chair

157
00:06:16,060 --> 00:06:12,320
in astrobiology

158
00:06:19,480 --> 00:06:16,070
and we actually have two chairs here

159
00:06:21,450 --> 00:06:19,490
today in a past in the current chair and

160
00:06:24,520 --> 00:06:21,460
the center of theological inquiry

161
00:06:27,010 --> 00:06:24,530
2015-17 study and residence project and

162
00:06:30,190 --> 00:06:27,020
inquiry on the societal implications of

163
00:06:32,890 --> 00:06:30,200

astrobiology and the 2015-2016 NASA

164

00:06:35,380 --> 00:06:32,900

asked astrobiology debates project and

165

00:06:37,270 --> 00:06:35,390

again if you are interested in more

166

00:06:39,210 --> 00:06:37,280

information on those activities see my

167

00:06:42,130 --> 00:06:39,220

blog post

168

00:06:44,860 --> 00:06:42,140

Bloomberg chair was conceived by Barry

169

00:06:46,630 --> 00:06:44,870

Bloomberg and named after him and it was

170

00:06:48,219 --> 00:06:46,640

created to support scholars interested

171

00:06:50,740 --> 00:06:48,229

in the intersection of the sciences and

172

00:06:52,369 --> 00:06:50,750

humanities and the work that these

173

00:06:54,450 --> 00:06:52,379

chairs had done as

174

00:06:58,050 --> 00:06:54,460

fascinating there have been a lot of

175

00:07:00,110 --> 00:06:58,060

public programs as well as private

176

00:07:02,550 --> 00:07:00,120

activities and a lot of private study

177

00:07:05,939 --> 00:07:02,560

David Grinspoon was the first Bloomberg

178

00:07:07,980 --> 00:07:05,949

chair Steve deck came next and Astoria

179

00:07:10,379 --> 00:07:07,990

named Nathaniel comfort and then louise

180

00:07:12,330 --> 00:07:10,389

campos is with us today and i say it's

181

00:07:14,939 --> 00:07:12,340

high for a woman's perspective let the

182

00:07:16,619 --> 00:07:14,949

next chair be a woman but i have no

183

00:07:22,020 --> 00:07:16,629

inside information on whether that will

184

00:07:24,330 --> 00:07:22,030

happen and in 2014 2015 instead of

185

00:07:26,879 --> 00:07:24,340

appointing a chair the bloomberg chair

186

00:07:28,589 --> 00:07:26,889

group decided to sponsor a series of

187

00:07:31,040 --> 00:07:28,599

interdisciplinary dialogues on

188

00:07:32,700 --> 00:07:31,050

astrobiology and they were on

189

00:07:35,339 --> 00:07:32,710

astrobiology and the religious

190

00:07:37,679 --> 00:07:35,349

imagination rethinking life on earth

191

00:07:39,860 --> 00:07:37,689

beyond the role of paradigm shifts and

192

00:07:41,790 --> 00:07:39,870

science and human self understanding and

193

00:07:43,830 --> 00:07:41,800

historical cultural and artistic

194

00:07:46,080 --> 00:07:43,840

perspectives on astrobiology and i was

195

00:07:48,269 --> 00:07:46,090

very lucky to be able to participate in

196

00:07:49,379 --> 00:07:48,279

all those dialogues met kelly smith it

197

00:07:52,290 --> 00:07:49,389

was a participant in one of the

198

00:07:54,839 --> 00:07:52,300

dialogues many many interesting ideas

199

00:07:56,790 --> 00:07:54,849

and perspectives so that was really a

200

00:07:58,709 --> 00:07:56,800

wonderful project and there is some

201
00:08:01,499 --> 00:07:58,719
record in terms of webcasts of the

202
00:08:03,420 --> 00:08:01,509
public programs from those dialogues one

203
00:08:05,040 --> 00:08:03,430
thing I observed as a social scientist

204
00:08:07,110 --> 00:08:05,050
during those dialogues were that the

205
00:08:09,570 --> 00:08:07,120
natural scientists who are participating

206
00:08:12,390 --> 00:08:09,580
tended to be quite optimistic about the

207
00:08:14,850 --> 00:08:12,400
human future on earth and in space while

208
00:08:18,119 --> 00:08:14,860
the humanistic scholars were virtually

209
00:08:20,909 --> 00:08:18,129
all pessimistic so that's you know we

210
00:08:22,980 --> 00:08:20,919
have different world views as to the

211
00:08:25,679 --> 00:08:22,990
center of theological inquiry project we

212
00:08:29,490 --> 00:08:25,689
have a at least a few participant space

213
00:08:31,559 --> 00:08:29,500

at Lucas was a participant of fellow you

214

00:08:34,259 --> 00:08:31,569

call yourselves fellows right last year

215

00:08:36,300 --> 00:08:34,269

in Eric person it's probably here he's a

216

00:08:39,509 --> 00:08:36,310

participant this year and if I forgotten

217

00:08:41,790 --> 00:08:39,519

anybody else oh and Frank Rosen's leg

218

00:08:45,900 --> 00:08:41,800

that's right it's participating this

219

00:08:48,509 --> 00:08:45,910

year as well and questions guiding that

220

00:08:50,880 --> 00:08:48,519

inquiry are along the lines if there are

221

00:08:52,439 --> 00:08:50,890

many different forms of life known and

222

00:08:55,139 --> 00:08:52,449

unknown to us what does it mean to be

223

00:08:57,540 --> 00:08:55,149

alive now we've heard a lot of that

224

00:08:58,889 --> 00:08:57,550

question in some form or other over the

225

00:09:00,689 --> 00:08:58,899

past three days I'm not going to read

226

00:09:03,540 --> 00:09:00,699

all the questions for the sake of time

227

00:09:05,160 --> 00:09:03,550

you can find them all online the debates

228

00:09:06,720 --> 00:09:05,170

project was really terrific

229

00:09:09,329 --> 00:09:06,730

it was very well organized

230

00:09:12,210 --> 00:09:09,339

and involved University and secondary

231

00:09:13,889 --> 00:09:12,220

education students and it was an

232

00:09:16,290 --> 00:09:13,899

opportunity for them to hone their

233

00:09:18,300 --> 00:09:16,300

debate skills as well as learn about the

234

00:09:20,160 --> 00:09:18,310

science of astrobiology and the

235

00:09:22,350 --> 00:09:20,170

organizers of the debates project pulled

236

00:09:24,780 --> 00:09:22,360

in a lot of experts both from the

237

00:09:27,509 --> 00:09:24,790

Natural Sciences and from philosophy and

238

00:09:29,550 --> 00:09:27,519

ethics it was very very interesting I

239

00:09:32,730 --> 00:09:29,560

was lucky enough to participate as a

240

00:09:34,650 --> 00:09:32,740

judge in in the final competition

241

00:09:36,900 --> 00:09:34,660

michael mayer was a judge as well i know

242

00:09:39,300 --> 00:09:36,910

michael myers here somewhere and so

243

00:09:40,680 --> 00:09:39,310

we'll be around later if you have any

244

00:09:43,350 --> 00:09:40,690

questions about any of these activities

245

00:09:53,850 --> 00:09:43,360

and i'm going to turn it over to Lucas

246

00:09:56,100 --> 00:09:53,860

to introduce our dialogue thank you for

247

00:09:59,370 --> 00:09:56,110

coming as you you all know some of the

248

00:10:02,699 --> 00:09:59,380

most exciting conversations happen over

249

00:10:04,230 --> 00:10:02,709

beer at astrobiology conferences and one

250

00:10:06,269 --> 00:10:04,240

of the challenges was to get some of the

251

00:10:08,730 --> 00:10:06,279

really interesting aspects of that

252

00:10:11,280 --> 00:10:08,740

conversation tied together with some of

253

00:10:14,040 --> 00:10:11,290

the humanities research and some of the

254

00:10:16,259 --> 00:10:14,050

fabulous speakers who have come to join

255

00:10:19,199 --> 00:10:16,269

us so I would like to introduce for our

256

00:10:21,420 --> 00:10:19,209

first pair we have Luis Campos who is an

257

00:10:23,100 --> 00:10:21,430

associate professor of history at the

258

00:10:25,590 --> 00:10:23,110

University of New Mexico

259

00:10:27,930 --> 00:10:25,600

he is the a senior fellow at the Robert

260

00:10:31,439 --> 00:10:27,940

Wood Johnson Foundation Center for

261

00:10:33,059 --> 00:10:31,449

Health Policy his ph.d is in history of

262

00:10:36,240 --> 00:10:33,069

science from Harvard which is where I

263

00:10:38,759 --> 00:10:36,250

met him he works on the intersection of

264

00:10:40,470 --> 00:10:38,769

genetics and society and recently

265

00:10:43,139 --> 00:10:40,480

published a fascinating book called

266

00:10:45,150 --> 00:10:43,149

radium and the secret of life which

267

00:10:50,040 --> 00:10:45,160

looks at the beginnings of modern

268

00:10:52,530 --> 00:10:50,050

synthetic biology he is the fourth and

269

00:10:55,319 --> 00:10:52,540

current Bloomberg Chair of astrobiology

270

00:10:58,079 --> 00:10:55,329

at the Library of Congress and he will

271

00:11:00,120 --> 00:10:58,089

be talking with Sarah Walker whom all of

272

00:11:02,670 --> 00:11:00,130

you probably already know but I will say

273

00:11:04,769 --> 00:11:02,680

she is the assistant professor of Earth

274

00:11:07,079 --> 00:11:04,779

and space exploration at Arizona State

275

00:11:09,420 --> 00:11:07,089

University and deputy director of the

276

00:11:12,389 --> 00:11:09,430

Beyond Center for fundamental concepts

277

00:11:15,420 --> 00:11:12,399

in science she got her PhD in physics

278

00:11:17,910 --> 00:11:15,430

from Dartmouth and is a theoretical

279

00:11:20,550 --> 00:11:17,920

physicist and astrobiologist working on

280

00:11:26,280 --> 00:11:20,560

the origin and nature of night life nice

281

00:11:28,620 --> 00:11:26,290

little topics she has recently released

282

00:11:31,769 --> 00:11:28,630

from matter to life information and

283

00:11:45,150 --> 00:11:31,779

causality from Cambridge Press which I

284

00:11:48,180 --> 00:11:45,160

would recommend as well please alright

285

00:11:49,950 --> 00:11:48,190

hello everyone I thought I would show

286

00:11:51,420 --> 00:11:49,960

you a few pictures of library Congress

287

00:11:52,620 --> 00:11:51,430

it's the place you often hear about but

288

00:11:54,480 --> 00:11:52,630

if you ever have a chance to come and

289

00:11:56,519 --> 00:11:54,490

visit please do and I will come and give

290

00:11:58,980 --> 00:11:56,529

you a tour around this wonderful

291

00:12:03,090 --> 00:11:58,990

People's Palace sorry this doesn't seem

292

00:12:09,890 --> 00:12:03,100

to be there we go advancing here and and

293

00:12:13,380 --> 00:12:09,900

it was a remarkable thing to sit not

294

00:12:15,390 --> 00:12:13,390

there we go wonderful thing to arrive at

295

00:12:17,130 --> 00:12:15,400

the library and to see all the amazing

296

00:12:19,019 --> 00:12:17,140

kinds of things that are there even

297

00:12:20,310 --> 00:12:19,029

books that have bindings like that on

298

00:12:21,630 --> 00:12:20,320

them which is really quite something we

299

00:12:24,329 --> 00:12:21,640

don't make looks like that anymore do we

300

00:12:25,950 --> 00:12:24,339

and then I discovered the email address

301
00:12:31,020 --> 00:12:25,960
that they had given me meant that I had

302
00:12:32,880 --> 00:12:31,030
discovered Luka just by complete chance

303
00:12:34,200 --> 00:12:32,890
right so out of all the audiences in the

304
00:12:37,829 --> 00:12:34,210
world that would appreciate this email

305
00:12:39,270 --> 00:12:37,839
address it is it is you guys so yeah so

306
00:12:41,610 --> 00:12:39,280
there's wonderful ways that one could do

307
00:12:42,630 --> 00:12:41,620
a deep cultural history at the Library

308
00:12:44,310 --> 00:12:42,640
of Congress and I hope there are many

309
00:12:46,110 --> 00:12:44,320
more Lumbergh chairs to come home

310
00:12:49,829 --> 00:12:46,120
explore these things I thought it was

311
00:12:51,240 --> 00:12:49,839
fun to find the little drawer there that

312
00:12:53,250 --> 00:12:51,250
had the Durer star chart with four

313
00:12:54,840 --> 00:12:53,260

exclamation point on it as something

314

00:12:56,640 --> 00:12:54,850

that even the people in the map division

315

00:12:58,430 --> 00:12:56,650

were very happy about you know lots of

316

00:13:01,440 --> 00:12:58,440

deeper histories we could look at how

317

00:13:03,300 --> 00:13:01,450

astronomy and biology came together etc

318

00:13:05,880 --> 00:13:03,310

etc how some of our more recent

319

00:13:08,640 --> 00:13:05,890

depictions of the Trappist one system

320

00:13:10,590 --> 00:13:08,650

might compare to earlier images of the

321

00:13:12,420 --> 00:13:10,600

deluge back in the 19th century we could

322

00:13:14,760 --> 00:13:12,430

bring in interesting art historians to

323

00:13:15,000 --> 00:13:14,770

analyze these things that is not what I

324

00:13:18,600 --> 00:13:15,010

do

325

00:13:19,710 --> 00:13:18,610

I read dead people's mail that's the the

326

00:13:21,510 --> 00:13:19,720

fun thing of reading other people's

327

00:13:23,370 --> 00:13:21,520

correspondents and reconstructing

328

00:13:25,500 --> 00:13:23,380

certain stories this was from Joshua

329

00:13:27,480 --> 00:13:25,510

Lederberg papers something that he sent

330

00:13:29,250 --> 00:13:27,490

to Carl Sagan and if you can see on the

331

00:13:30,660 --> 00:13:29,260

bottom it says well this mission answers

332

00:13:32,400 --> 00:13:30,670

at least one big question are there

333

00:13:34,710 --> 00:13:32,410

other planets like ours in

334

00:13:37,740 --> 00:13:34,720

universe so you've probably seen other

335

00:13:41,100 --> 00:13:37,750

images like this one very familiar one

336

00:13:42,240 --> 00:13:41,110

for for some of us and we'll be future

337

00:13:43,680 --> 00:13:42,250

historians who will look at this

338

00:13:45,569 --> 00:13:43,690

particular moment of these sorts of

339

00:13:48,900 --> 00:13:45,579

discoveries that land on the front page

340

00:13:51,090 --> 00:13:48,910

of the New York Times and on the same

341

00:13:53,249 --> 00:13:51,100

day on my Facebook feed an artist had

342

00:13:55,079 --> 00:13:53,259

created this image and I'm sure this is

343

00:13:58,050 --> 00:13:55,089

also something that will be analyzed by

344

00:14:00,840 --> 00:13:58,060

future cultural historians looking at

345

00:14:02,790 --> 00:14:00,850

our particular moment here I use archaic

346

00:14:03,809 --> 00:14:02,800

technology sometimes there's lots of

347

00:14:05,699 --> 00:14:03,819

different ways that one has to

348

00:14:08,369 --> 00:14:05,709

reconstruct the past including sometimes

349

00:14:09,749 --> 00:14:08,379

even tapping into the card catalog Carl

350

00:14:10,590 --> 00:14:09,759

Sagan in particular is a wonderful

351

00:14:13,470 --> 00:14:10,600

person to research at the library

352

00:14:16,230 --> 00:14:13,480

there's 1,700 boxes of his stuff there

353

00:14:17,600 --> 00:14:16,240

that's 2 million items I think it's

354

00:14:20,100 --> 00:14:17,610

really kind of remarkable and there are

355

00:14:22,980 --> 00:14:20,110

13,000 books that come in every day

356

00:14:24,480 --> 00:14:22,990

Lucas had just mentioned my book here

357

00:14:26,160 --> 00:14:24,490

and so I wanted to give you a quick

358

00:14:29,660 --> 00:14:26,170

little story about these intersections

359

00:14:32,519 --> 00:14:29,670

of synthetic biology and of astrobiology

360

00:14:35,970 --> 00:14:32,529

and what I'm calling in my project life

361

00:14:38,400 --> 00:14:35,980

as it could be this particular man back

362

00:14:41,069 --> 00:14:38,410

in 1905 John Butler Burke working at the

363

00:14:43,350 --> 00:14:41,079

Cavendish laboratory in Cambridge

364

00:14:46,650 --> 00:14:43,360

thought that he had found new insights

365

00:14:48,170 --> 00:14:46,660

into the origin of life and this seems

366

00:14:51,329 --> 00:14:48,180

to be kind of an early moment where

367

00:14:53,480 --> 00:14:51,339

spontaneous generation research was

368

00:14:56,129 --> 00:14:53,490

being relabeled into origins of life

369

00:14:58,009 --> 00:14:56,139

research here you can see the

370

00:15:01,050 --> 00:14:58,019

description putting radium into

371

00:15:06,660 --> 00:15:01,060

sterilized bullion he produced these

372

00:15:08,220 --> 00:15:06,670

lifelike swarms excuse me this was

373

00:15:11,160 --> 00:15:08,230

reported across both sides of the

374

00:15:13,590 --> 00:15:11,170

Atlantic Ocean kind of remarkably here's

375

00:15:16,230 --> 00:15:13,600

the setup here he thought that in a

376

00:15:18,629 --> 00:15:16,240

model for the early Earth would be more

377

00:15:20,160 --> 00:15:18,639

intensely radioactive and so he took

378

00:15:22,889 --> 00:15:20,170

some radium which was all the rage at

379

00:15:25,049 --> 00:15:22,899

the time put it into some beef bouillon

380

00:15:27,960 --> 00:15:25,059

here and produced these things that were

381

00:15:31,290 --> 00:15:27,970

half radium and half microbe and so he

382

00:15:33,650 --> 00:15:31,300

called them radios they grew and

383

00:15:37,199 --> 00:15:33,660

subdivided over the space of a few weeks

384

00:15:38,519 --> 00:15:37,209

they decayed in sunlight but these were

385

00:15:40,499 --> 00:15:38,529

these forms that he thought would be

386

00:15:41,490 --> 00:15:40,509

illustrative a model for the origin of

387

00:15:43,740 --> 00:15:41,500

life on the

388

00:15:46,620 --> 00:15:43,750

earlier--the this is with a camera

389

00:15:48,870 --> 00:15:46,630

lucida and so you see they begin to look

390

00:15:50,100 --> 00:15:48,880

less and less like things you might find

391

00:15:51,720 --> 00:15:50,110

with a photograph but he called him a

392

00:15:54,210 --> 00:15:51,730

photograph and published them in his

393

00:15:56,160 --> 00:15:54,220

book so there are interesting deeper

394

00:15:59,490 --> 00:15:56,170

connections we can look at between the

395

00:16:00,930 --> 00:15:59,500

origin of life and and efforts at

396

00:16:03,870 --> 00:16:00,940

biological engineering of trying to

397

00:16:06,480 --> 00:16:03,880

control and predict the future of what

398

00:16:08,550 --> 00:16:06,490

life could be so that was my previous

399

00:16:10,710 --> 00:16:08,560

project and one of the things that kind

400

00:16:12,630 --> 00:16:10,720

of symbolizes wonderfully the things

401
00:16:15,480 --> 00:16:12,640
that I'm discovering now was a birthday

402
00:16:18,260 --> 00:16:15,490
card that was sent by Herman J Muller

403
00:16:20,940 --> 00:16:18,270
who was also very interested in these

404
00:16:22,860 --> 00:16:20,950
phenomena of radium and life now if I

405
00:16:25,230 --> 00:16:22,870
can get past here this is the nature

406
00:16:27,660 --> 00:16:25,240
article on it the public display of it

407
00:16:29,460 --> 00:16:27,670
here is from Muller's papers where he

408
00:16:31,020 --> 00:16:29,470
thought radium would be a really

409
00:16:33,660 --> 00:16:31,030
interesting mutagen to use and he began

410
00:16:36,240 --> 00:16:33,670
to do x-ray mutagenesis in Drosophila as

411
00:16:38,880 --> 00:16:36,250
a result of this and he was a mentor to

412
00:16:40,260 --> 00:16:38,890
Carl Sagan and they talked about the

413
00:16:41,970 --> 00:16:40,270

possibilities of life on other worlds

414

00:16:44,010 --> 00:16:41,980

what it would look like Muller was very

415

00:16:47,490 --> 00:16:44,020

interested in engineering new forms of

416

00:16:50,480 --> 00:16:47,500

life and of other possible life forms

417

00:16:54,240 --> 00:16:50,490

that could come to come to exist and

418

00:16:56,460 --> 00:16:54,250

Sagan then in 1955 I believe it was sent

419

00:17:00,600 --> 00:16:56,470

Muller a birthday card which was an

420

00:17:02,970 --> 00:17:00,610

image of Mars from 1955 I think it was

421

00:17:04,710 --> 00:17:02,980

that had a red thread across it and said

422

00:17:06,960 --> 00:17:04,720

the thread of destiny rises ever higher

423

00:17:09,439 --> 00:17:06,970

or words to that effect and so it's kind

424

00:17:12,300 --> 00:17:09,449

of a wonderful way that we can see

425

00:17:14,880 --> 00:17:12,310

long-term earlier studies at the origin

426

00:17:16,260 --> 00:17:14,890

of life trying to understand how it

427

00:17:17,790 --> 00:17:16,270

might have emerged to how we might model

428

00:17:19,590 --> 00:17:17,800

that ties in

429

00:17:21,120 --> 00:17:19,600

excuse-me with people who are otherwise

430

00:17:22,350 --> 00:17:21,130

very interested in trying to think about

431

00:17:24,870 --> 00:17:22,360

how we might engineer new kinds of

432

00:17:27,770 --> 00:17:24,880

living systems using ionizing radiation

433

00:17:30,210 --> 00:17:27,780

and other forms and who might be able to

434

00:17:32,820 --> 00:17:30,220

give insights into other forms of life

435

00:17:34,350 --> 00:17:32,830

that could exist in the universe so it's

436

00:17:36,800 --> 00:17:34,360

taken me through a number of other

437

00:17:38,850 --> 00:17:36,810

debates on in hiren sea and contingency

438

00:17:40,440 --> 00:17:38,860

simpson of course the non problems

439

00:17:44,190 --> 00:17:40,450

humanoids was a very big piece at the

440

00:17:45,450 --> 00:17:44,200

time and be the common structure that i

441

00:17:48,420 --> 00:17:45,460

see that i think is a very interesting

442

00:17:51,300 --> 00:17:48,430

thing to look at more between the

443

00:17:54,840 --> 00:17:51,310

history of efforts to create life in the

444

00:17:57,330 --> 00:17:54,850

test tube to synthesize it from scratch

445

00:17:59,100 --> 00:17:57,340

and how that was claimed to have been

446

00:18:01,260 --> 00:17:59,110

successful at many points over the last

447

00:18:02,580 --> 00:18:01,270

century and at every point we shifted

448

00:18:05,130 --> 00:18:02,590

what we thought the fundamental feature

449

00:18:07,080 --> 00:18:05,140

of life was so that we then said it

450

00:18:09,510 --> 00:18:07,090

didn't actually happen after all that

451
00:18:11,070 --> 00:18:09,520
mode of conducting science in the future

452
00:18:13,380 --> 00:18:11,080
perfect I think is something that might

453
00:18:15,630 --> 00:18:13,390
be a useful thought for what

454
00:18:17,550 --> 00:18:15,640
astrobiology is future might look like

455
00:18:19,560 --> 00:18:17,560
that we might make lots of progress in

456
00:18:21,420 --> 00:18:19,570
understanding the nature of life and the

457
00:18:23,070 --> 00:18:21,430
context for its emergence without ever

458
00:18:24,870 --> 00:18:23,080
actually reaching a moment where we say

459
00:18:26,070 --> 00:18:24,880
oh how we've done it or we might reach

460
00:18:28,980 --> 00:18:26,080
several moments where we think that we

461
00:18:32,040 --> 00:18:28,990
have so the questions that I had in mind

462
00:18:34,320 --> 00:18:32,050
that I'd like to quick offer to Sara

463
00:18:37,380 --> 00:18:34,330

here have to do with this sort of weird

464

00:18:39,750 --> 00:18:37,390

story about radium and life here about

465

00:18:41,820 --> 00:18:39,760

thinking about substrates for life other

466

00:18:43,920 --> 00:18:41,830

than those that we are familiar with and

467

00:18:45,630 --> 00:18:43,930

how they might be useful for us and in

468

00:18:48,750 --> 00:18:45,640

light of kind of mid-century comments

469

00:18:50,160 --> 00:18:48,760

from NW Peary and other people who said

470

00:18:53,130 --> 00:18:50,170

that there's often a tendency to

471

00:18:54,720 --> 00:18:53,140

associate life with whatever the newly

472

00:18:57,330 --> 00:18:54,730

kind of discovered type of phenomenon is

473

00:19:00,990 --> 00:18:57,340

that we have magnetism or chirality

474

00:19:02,640 --> 00:19:01,000

optical activity proteins etc and so

475

00:19:05,370 --> 00:19:02,650

when we when we look at that when we

476

00:19:07,380 --> 00:19:05,380

look at ideas that the genetic code

477

00:19:09,690 --> 00:19:07,390

itself comes from cultural ideas of

478

00:19:11,670 --> 00:19:09,700

cryptography in the Cold War when we

479

00:19:14,040 --> 00:19:11,680

look at concepts of habitability that

480

00:19:15,840 --> 00:19:14,050

come from concepts of abodes much

481

00:19:18,330 --> 00:19:15,850

earlier on through RAND Corporation

482

00:19:21,200 --> 00:19:18,340

reports that talk about the habitability

483

00:19:23,310 --> 00:19:21,210

of plants per man there's a way that

484

00:19:28,220 --> 00:19:23,320

scientific understandings of life in

485

00:19:30,480 --> 00:19:28,230

every decade in every period basically

486

00:19:32,730 --> 00:19:30,490

reflect the culture that produced them

487

00:19:34,680 --> 00:19:32,740

and so given that that seems to be the

488

00:19:36,630 --> 00:19:34,690

case of what the historians see and what

489

00:19:37,770 --> 00:19:36,640

they think about over time I'd like to

490

00:19:40,170 --> 00:19:37,780

ask Sarah you know what does this mean

491

00:19:42,030 --> 00:19:40,180

for her claims about going digital with

492

00:19:44,460 --> 00:19:42,040

life given that we have all the digital

493

00:19:51,110 --> 00:19:44,470

things around us so I will toss over to

494

00:19:59,640 --> 00:19:57,660

all right so I will probably answer your

495

00:20:00,810 --> 00:19:59,650

question through my comments and then I

496

00:20:02,940 --> 00:20:00,820

can dress it a little bit more

497

00:20:04,560 --> 00:20:02,950

specifically so I put what is life

498

00:20:06,030 --> 00:20:04,570

Progress and problems but I actually

499

00:20:08,310 --> 00:20:06,040

probably should have said that this is

500

00:20:11,460 --> 00:20:08,320

really just a disciplinary perspective

501
00:20:12,750 --> 00:20:11,470
on the question of what is life and so

502
00:20:14,070 --> 00:20:12,760
we have been seeing that throughout this

503
00:20:15,960 --> 00:20:14,080
conference that different people

504
00:20:18,870 --> 00:20:15,970
approach the problem in very different

505
00:20:20,430 --> 00:20:18,880
ways I was trained in cosmology and so I

506
00:20:22,230 --> 00:20:20,440
tend to think about life as a

507
00:20:24,140 --> 00:20:22,240
cosmologists oh think about life and

508
00:20:26,550 --> 00:20:24,150
that is probably a very non-traditional

509
00:20:28,860 --> 00:20:26,560
perspective on thinking about living

510
00:20:31,200 --> 00:20:28,870
systems so I wanted to try to give you

511
00:20:34,050 --> 00:20:31,210
sort of the cosmologists I view of life

512
00:20:35,490 --> 00:20:34,060
but always remembering that when we're

513
00:20:38,070 --> 00:20:35,500

talking about the problem what is life

514

00:20:39,870 --> 00:20:38,080

it's a very deep conceptual issue and so

515

00:20:41,280 --> 00:20:39,880

I think what really we need to figure

516

00:20:42,780 --> 00:20:41,290

out is how are these disciplines

517

00:20:47,040 --> 00:20:42,790

actually saying the same thing or where

518

00:20:48,570 --> 00:20:47,050

they saying something different so I

519

00:20:51,090 --> 00:20:48,580

felt kind of compelled to put this slide

520

00:20:52,440 --> 00:20:51,100

up it's a little obligatory at this

521

00:20:54,270 --> 00:20:52,450

stage we actually had a whole discussion

522

00:20:56,700 --> 00:20:54,280

in the laws of life session yesterday

523

00:20:58,590 --> 00:20:56,710

about this seminal book that or one

524

00:21:00,690 --> 00:20:58,600

shortage I wrote but the thing that

525

00:21:02,400 --> 00:21:00,700

really resonates for me about this book

526
00:21:03,960 --> 00:21:02,410
is actually his conjecture that other

527
00:21:06,450 --> 00:21:03,970
laws of physics were necessary to

528
00:21:07,770 --> 00:21:06,460
describe life and so for me the

529
00:21:10,080 --> 00:21:07,780
physicist is that actually what

530
00:21:12,060 --> 00:21:10,090
motivates me to be interested in

531
00:21:16,860 --> 00:21:12,070
thinking about living systems and what

532
00:21:18,920 --> 00:21:16,870
excites me about astrobiology and it's

533
00:21:23,310 --> 00:21:18,930
fascinating for me thinking about life

534
00:21:24,810 --> 00:21:23,320
how how this intersects with with some

535
00:21:26,640 --> 00:21:24,820
of the conceptual issues that we really

536
00:21:28,620 --> 00:21:26,650
do face in the kind of questions we ask

537
00:21:32,040 --> 00:21:28,630
as astrobiologists so this is one of my

538
00:21:34,530 --> 00:21:32,050

favorite quotes about our current

539

00:21:35,730 --> 00:21:34,540

knowledge of physics which is that the

540

00:21:37,080 --> 00:21:35,740

theory of everything is a theory of

541

00:21:39,060 --> 00:21:37,090

everything except those things that

542

00:21:41,610 --> 00:21:39,070

theorized and so the reason for bringing

543

00:21:43,830 --> 00:21:41,620

this up is if we could imagine that we

544

00:21:46,800 --> 00:21:43,840

had an understanding of life and we even

545

00:21:49,050 --> 00:21:46,810

had a theory of living systems we had a

546

00:21:49,950 --> 00:21:49,060

theory like a theoretical astrobiology

547

00:21:52,590 --> 00:21:49,960

in the same sense that we have a

548

00:21:56,430 --> 00:21:52,600

theoretical physics would it be actually

549

00:21:58,080 --> 00:21:56,440

a theory of things that theorized and is

550

00:21:59,580 --> 00:21:58,090

that an interesting or relevant question

551

00:22:01,169 --> 00:21:59,590

to ask is that is that

552

00:22:05,070 --> 00:22:01,179

the way we should be framing the

553

00:22:06,930 --> 00:22:05,080

question our current status of how we

554

00:22:09,389 --> 00:22:06,940

think about life in the scientific

555

00:22:11,190 --> 00:22:09,399

community is a compendium of different

556

00:22:15,360 --> 00:22:11,200

perspectives and so this paper is

557

00:22:17,879 --> 00:22:15,370

actually quite remarkable in terms of

558

00:22:21,180 --> 00:22:17,889

how it has collected all the various

559

00:22:22,919 --> 00:22:21,190

definitions for life in one paper and

560

00:22:24,690 --> 00:22:22,929

try to extract a definition as a

561

00:22:27,330 --> 00:22:24,700

compilation of the various definitions

562

00:22:29,669 --> 00:22:27,340

so this is kind of a really interesting

563

00:22:31,619 --> 00:22:29,679

insight into the current state of our

564

00:22:33,119 --> 00:22:31,629

knowledge in the field we're at a state

565

00:22:35,070 --> 00:22:33,129

where we have so many definitions that

566

00:22:37,710 --> 00:22:35,080

you can actually accumulate definitions

567

00:22:39,149 --> 00:22:37,720

and make a new definition and sometimes

568

00:22:42,629 --> 00:22:39,159

people ask me why I have an IP address

569

00:22:45,269 --> 00:22:42,639

in there that was actually a mistake but

570

00:22:47,609 --> 00:22:45,279

I left it and I'll kind of allude to

571

00:22:50,580 --> 00:22:47,619

that in a minute about which gets to the

572

00:22:52,379 --> 00:22:50,590

information aspect is is actually you

573

00:22:57,379 --> 00:22:52,389

know maybe that's part of the story of

574

00:23:01,440 --> 00:22:57,389

life so there's a lot of discussion

575

00:23:03,930 --> 00:23:01,450

about what life is and how we should be

576

00:23:07,680 --> 00:23:03,940

thinking about the problem and so one of

577

00:23:09,180 --> 00:23:07,690

the the conceptual issues in that

578

00:23:11,489 --> 00:23:09,190

question that I think is really

579

00:23:15,029 --> 00:23:11,499

interesting is what scale are we even

580

00:23:17,759 --> 00:23:15,039

talking about and so usually we'll think

581

00:23:20,009 --> 00:23:17,769

about life as a chemical phenomena this

582

00:23:22,379 --> 00:23:20,019

is the way that we have really been

583

00:23:23,759 --> 00:23:22,389

trained to think about it and in

584

00:23:25,320 --> 00:23:23,769

particular national biology we're often

585

00:23:28,859 --> 00:23:25,330

talking about looking for chemical

586

00:23:30,029 --> 00:23:28,869

products of life but all of you a lot of

587

00:23:33,629 --> 00:23:30,039

people in this room actually probably

588

00:23:35,119 --> 00:23:33,639

flew in for this conference over Phoenix

589

00:23:39,930 --> 00:23:35,129

that might have seen a view like this

590

00:23:46,109 --> 00:23:39,940

this is life is it as much life as the

591

00:23:47,549 --> 00:23:46,119

chemistry happening inside yourself what

592

00:23:50,850 --> 00:23:47,559

about all of these different levels of

593

00:23:52,710 --> 00:23:50,860

organization and the biosphere and so

594

00:23:54,509 --> 00:23:52,720

when physicists are thinking about life

595

00:23:57,149 --> 00:23:54,519

in particular from a complex systems

596

00:23:58,649 --> 00:23:57,159

perspective oftentimes they're making

597

00:24:00,210 --> 00:23:58,659

the argument nowadays that life is

598

00:24:01,950 --> 00:24:00,220

actually the hierarchy of these

599

00:24:03,539 --> 00:24:01,960

structures it's not any one individual

600

00:24:05,070 --> 00:24:03,549

level it's actually the structure as a

601
00:24:07,529 --> 00:24:05,080
whole and I think this is a really

602
00:24:08,909 --> 00:24:07,539
interesting kind of shift in the way

603
00:24:12,359 --> 00:24:08,919
that we're thinking about the problem

604
00:24:13,080 --> 00:24:12,369
and so these transitions in our thinking

605
00:24:14,730 --> 00:24:13,090
are actually real

606
00:24:16,320 --> 00:24:14,740
interesting is this going to be a new

607
00:24:18,270 --> 00:24:16,330
way of thinking about it is a useful way

608
00:24:20,100 --> 00:24:18,280
of thinking about it does it help solve

609
00:24:22,380 --> 00:24:20,110
problems like the problem of the origin

610
00:24:24,660 --> 00:24:22,390
of life to think about the origin

611
00:24:27,090 --> 00:24:24,670
problem as an actual multi scale problem

612
00:24:28,470 --> 00:24:27,100
that you don't just need the molecules

613
00:24:29,910 --> 00:24:28,480

to come together first but you actually

614

00:24:32,120 --> 00:24:29,920

need things to happen at different

615

00:24:38,580 --> 00:24:32,130

scales populations at the same time as

616

00:24:41,040 --> 00:24:38,590

individual components so so what we've

617

00:24:42,450 --> 00:24:41,050

alluded to the fact that I'm kind of

618

00:24:43,890 --> 00:24:42,460

obsessed with information and it's

619

00:24:46,350 --> 00:24:43,900

probably because we do live in a digital

620

00:24:49,590 --> 00:24:46,360

age so I think I'm totally biased by the

621

00:24:51,840 --> 00:24:49,600

current you know state of knowledge but

622

00:24:54,300 --> 00:24:51,850

one thing that I think is if you take

623

00:24:57,390 --> 00:24:54,310

this view of life at the hierarchy there

624

00:24:58,650 --> 00:24:57,400

is you have a problem of looking at all

625

00:25:00,690 --> 00:24:58,660

of these different scales looking at

626

00:25:02,580 --> 00:25:00,700

things like cities and cells what could

627

00:25:04,080 --> 00:25:02,590

possibly be common about those that you

628

00:25:06,840 --> 00:25:04,090

could say they're both life they're both

629

00:25:08,640 --> 00:25:06,850

the same thing at their core and the one

630

00:25:09,960 --> 00:25:08,650

thing that maybe stands out in that

631

00:25:11,940 --> 00:25:09,970

regard is that all of these different

632

00:25:13,860 --> 00:25:11,950

scales process information and they have

633

00:25:15,300 --> 00:25:13,870

information associated with them so in

634

00:25:17,310 --> 00:25:15,310

the origins community we often have

635

00:25:21,090 --> 00:25:17,320

debates about metabolism versus genetics

636

00:25:23,040 --> 00:25:21,100

and genetics is interpreted as being

637

00:25:24,960 --> 00:25:23,050

sort of an informational role in the

638

00:25:26,280 --> 00:25:24,970

cell but in this sense information is

639

00:25:27,810 --> 00:25:26,290

much more distributed property of

640

00:25:30,210 --> 00:25:27,820

networks so it's kind of a different

641

00:25:31,830 --> 00:25:30,220

concept of information than what we

642

00:25:34,740 --> 00:25:31,840

traditionally think about in the origins

643

00:25:36,300 --> 00:25:34,750

community and just to give one example I

644

00:25:38,490 --> 00:25:36,310

love this example about thinking about

645

00:25:40,290 --> 00:25:38,500

different scales and thinking about what

646

00:25:44,060 --> 00:25:40,300

life is we don't usually think about

647

00:25:47,580 --> 00:25:44,070

cities is alive but you might think of a

648

00:25:50,400 --> 00:25:47,590

slime mold as a live and you'll notice

649

00:25:54,690 --> 00:25:50,410

that these two things have very similar

650

00:25:56,520 --> 00:25:54,700

patterns that's not by coincidence what

651
00:25:58,670 --> 00:25:56,530
was done in this experiment with a slime

652
00:26:01,230 --> 00:25:58,680
mold is this is the city of Tokyo and

653
00:26:03,750 --> 00:26:01,240
there are particular locations of subway

654
00:26:05,580 --> 00:26:03,760
stations in Tokyo and the engineers in

655
00:26:07,890 --> 00:26:05,590
Tokyo had a particular design challenge

656
00:26:10,140 --> 00:26:07,900
of building the subway based on the

657
00:26:13,050 --> 00:26:10,150
where those locations could be and that

658
00:26:16,140 --> 00:26:13,060
basically informed the design of the

659
00:26:18,330 --> 00:26:16,150
entire city in this experiment the food

660
00:26:20,100 --> 00:26:18,340
sources were basically distributed at

661
00:26:22,230 --> 00:26:20,110
the same distribution as the city of

662
00:26:23,830 --> 00:26:22,240
Tokyo and so you get the same kind of

663
00:26:30,280 --> 00:26:23,840

informational patterns

664

00:26:32,320 --> 00:26:30,290

and so this is an exercise in looking at

665

00:26:34,300 --> 00:26:32,330

it from a really radically different

666

00:26:36,280 --> 00:26:34,310

perspective and so the reason I just put

667

00:26:38,380 --> 00:26:36,290

up this paper that we wrote on this

668

00:26:40,240 --> 00:26:38,390

perspective here is just to just

669

00:26:42,280 --> 00:26:40,250

demonstrate that if you have a very

670

00:26:43,900 --> 00:26:42,290

different disciplinary review the things

671

00:26:45,400 --> 00:26:43,910

you think about being critical to life

672

00:26:48,640 --> 00:26:45,410

are very different than the traditional

673

00:26:51,130 --> 00:26:48,650

view and so when we have these

674

00:26:52,270 --> 00:26:51,140

conversations about living systems we

675

00:26:54,430 --> 00:26:52,280

need to really think about these things

676

00:26:57,250 --> 00:26:54,440

so I am running out of time I'm just

677

00:27:02,320 --> 00:26:57,260

going to UM talk about do I have a

678

00:27:04,450 --> 00:27:02,330

minute okay that's fine I will anyway we

679

00:27:12,520 --> 00:27:04,460

have time for discussion all right thank

680

00:27:14,110 --> 00:27:12,530

you so it's terrible when we have so

681

00:27:16,240 --> 00:27:14,120

many fascinating things to talk about

682

00:27:18,010 --> 00:27:16,250

but we're going to be a little bit

683

00:27:19,780 --> 00:27:18,020

brusque today just to make sure that you

684

00:27:22,210 --> 00:27:19,790

get a chance to ask people questions if

685

00:27:23,920 --> 00:27:22,220

you have them our second group we have

686

00:27:25,740 --> 00:27:23,930

John burrows who most of you know

687

00:27:27,700 --> 00:27:25,750

professor of Oceanography and

688

00:27:30,430 --> 00:27:27,710

astrobiology at the University of

689

00:27:33,220 --> 00:27:30,440

Washington with woody Sullivan he edited

690

00:27:35,410 --> 00:27:33,230

planets and life he got his PhD in

691

00:27:37,450 --> 00:27:35,420

marine microbiology from the University

692

00:27:39,520 --> 00:27:37,460

of Washington and has been instrumental

693

00:27:42,580 --> 00:27:39,530

in the formation of the dynamic

694

00:27:43,830 --> 00:27:42,590

astrobiology program that exists there

695

00:27:46,750 --> 00:27:43,840

today

696

00:27:49,240 --> 00:27:46,760

he was co-chair of the Bloomberg

697

00:27:52,900 --> 00:27:49,250

dialogues and astrobiology and religion

698

00:27:55,900 --> 00:27:52,910

history and philosophy and the arts and

699

00:27:59,200 --> 00:27:55,910

works on the SETI Institute science

700

00:28:01,210 --> 00:27:59,210

advisory board I know he's also had many

701
00:28:04,060 --> 00:28:01,220
conversations with monks and priests

702
00:28:07,420 --> 00:28:04,070
about science that give him a unique

703
00:28:09,460 --> 00:28:07,430
perspective he will be talking with

704
00:28:11,950 --> 00:28:09,470
Hester over mom who teaches religious

705
00:28:13,210 --> 00:28:11,960
studies at the University of Arizona she

706
00:28:15,730 --> 00:28:13,220
works on the intersection between

707
00:28:17,410 --> 00:28:15,740
religion science and psychology with a

708
00:28:19,690 --> 00:28:17,420
particular interest in how they play out

709
00:28:22,150 --> 00:28:19,700
in modern medicine she got her master's

710
00:28:24,850 --> 00:28:22,160
at the Free University in sacred texts

711
00:28:27,280 --> 00:28:24,860
in comparative religion where she had to

712
00:28:30,280 --> 00:28:27,290
learn seven languages which I find

713
00:28:32,350 --> 00:28:30,290

entirely daunting she also has a PhD

714

00:28:34,330 --> 00:28:32,360
from the University of Leiden in

715

00:28:36,520 --> 00:28:34,340
psychology and philosophy of religion

716

00:28:37,539 --> 00:28:36,530
she has published on that with a

717

00:28:48,269 --> 00:28:37,549
particular interest

718

00:28:50,169 --> 00:28:48,279
in consciousness non-tech part of this

719

00:28:52,600 --> 00:28:50,179
discussion and actually have a

720

00:28:56,169 --> 00:28:52,610
discussion and I have been asked to

721

00:28:58,810 --> 00:28:56,179
start off as then I don't want to call

722

00:29:00,669 --> 00:28:58,820
myself the ugly duckling but the odd one

723

00:29:03,700 --> 00:29:00,679
out in this group as being a theologian

724

00:29:06,399 --> 00:29:03,710
trained in Holland in Europe in a duplex

725

00:29:09,399 --> 00:29:06,409
or dough which theology means there that

726
00:29:10,810 --> 00:29:09,409
your academic and not faith-based but

727
00:29:12,729 --> 00:29:10,820
then all the money comes from

728
00:29:15,039 --> 00:29:12,739
faith-based organizations so I have

729
00:29:18,399 --> 00:29:15,049
never figured that out until I came to

730
00:29:21,159 --> 00:29:18,409
America never followed the money but now

731
00:29:22,989 --> 00:29:21,169
that I'm here in America can really

732
00:29:26,950 --> 00:29:22,999
become interested in the

733
00:29:30,970 --> 00:29:26,960
interdisciplinary dialogue between the

734
00:29:33,159 --> 00:29:30,980
humanities and Sciences as I very much

735
00:29:36,279 --> 00:29:33,169
struck that we in the humanities and I

736
00:29:38,229 --> 00:29:36,289
speak of religious studies and truly the

737
00:29:41,739 --> 00:29:38,239
humanities not social sciences are

738
00:29:46,239 --> 00:29:41,749

monolingual and build walls to keep the

739

00:29:49,239 --> 00:29:46,249

nasty evil empire of science out and and

740

00:29:51,639 --> 00:29:49,249

that deep kind of knee-jerk reaction

741

00:29:54,879 --> 00:29:51,649

that that is the enemy and the other

742

00:29:58,539 --> 00:29:54,889

that needs to be either attacked or

743

00:29:59,979 --> 00:29:58,549

ignored is I think a real problem and

744

00:30:01,479 --> 00:29:59,989

then problem that I want to hope to

745

00:30:05,019 --> 00:30:01,489

address with John it's kind of the

746

00:30:08,580 --> 00:30:05,029

science phobia so what I want to talk

747

00:30:11,190 --> 00:30:08,590

and ask John about as the scientist here

748

00:30:14,379 --> 00:30:11,200

coming from the humanities is

749

00:30:17,409 --> 00:30:14,389

astrobiology is inter interdisciplinary

750

00:30:20,049 --> 00:30:17,419

by nature and of course attracts a

751

00:30:23,159 --> 00:30:20,059

fascination and imagination of all the

752

00:30:26,139 --> 00:30:23,169

disciplines but we talk about it as

753

00:30:28,989 --> 00:30:26,149

astrobiology isn't there a need for an

754

00:30:32,769 --> 00:30:28,999

astro humanity or even more so of an

755

00:30:34,960 --> 00:30:32,779

Astro phenomenology and I want you to I

756

00:30:36,690 --> 00:30:34,970

will have more dialogue and I can follow

757

00:30:41,919 --> 00:30:36,700

up with more information

758

00:30:43,210 --> 00:30:41,929

that's an interesting now is it a hear

759

00:30:46,220 --> 00:30:43,220

us

760

00:30:48,049 --> 00:30:46,230

yeah it's an interesting way to go we

761

00:30:50,720 --> 00:30:48,059

actually had a little discussion this

762

00:30:53,270 --> 00:30:50,730

afternoon on this and of course we're

763

00:30:54,890 --> 00:30:53,280

very much motivated on this because I

764

00:30:57,770 --> 00:30:54,900

think of the problem of science

765

00:31:02,530 --> 00:30:57,780

illiteracy in this country and in many

766

00:31:08,320 --> 00:31:05,780

corresponds in some cases to religious

767

00:31:10,970 --> 00:31:08,330

beliefs also given that we are

768

00:31:15,159 --> 00:31:10,980

predominantly a religious country in

769

00:31:21,919 --> 00:31:15,169

many many ways and so the idea is really

770

00:31:23,960 --> 00:31:21,929

how do we communicate across the various

771

00:31:27,590 --> 00:31:23,970

kinds of religion how do we communicate

772

00:31:30,470 --> 00:31:27,600

with them about how science actually

773

00:31:32,720 --> 00:31:30,480

does interact with their belief base and

774

00:31:34,850 --> 00:31:32,730

how it interacts with their think their

775

00:31:37,310 --> 00:31:34,860

philosophical and theological base I

776

00:31:40,760 --> 00:31:37,320

like to point out and running a blue

777

00:31:45,470 --> 00:31:40,770

berg dialogues with Derek Malone France

778

00:31:47,210 --> 00:31:45,480

who was a professor of philosophy

779

00:31:49,820 --> 00:31:47,220

religion at George Washington University

780

00:31:52,220 --> 00:31:49,830

and putting together

781

00:31:54,980 --> 00:31:52,230

I think the Bloomberg dialogues on

782

00:31:57,980 --> 00:31:54,990

astrobiology and religion one of the big

783

00:32:01,190 --> 00:31:57,990

questions that I asked related to my

784

00:32:03,289 --> 00:32:01,200

personal interest is a better

785

00:32:06,500 --> 00:32:03,299

understanding of the core rationale

786

00:32:08,570 --> 00:32:06,510

motivation for religion and why or why

787

00:32:11,150 --> 00:32:08,580

not is it essential for human existence

788

00:32:13,870 --> 00:32:11,160

and whether or not discoveries in

789

00:32:16,100 --> 00:32:13,880

astrobiology could impact those core

790

00:32:18,950 --> 00:32:16,110

reasons for the origin and

791

00:32:22,010 --> 00:32:18,960

sustainability of religious beliefs why

792

00:32:25,130 --> 00:32:22,020

religion and so I please pose that to

793

00:32:27,940 --> 00:32:25,140

this group of people academics in a

794

00:32:32,240 --> 00:32:27,950

variety of different you know religious

795

00:32:36,740 --> 00:32:32,250

beliefs and in many ways they found it I

796

00:32:39,230 --> 00:32:36,750

think interesting and also confusing as

797

00:32:40,970 --> 00:32:39,240

to how to actually really address these

798

00:32:44,180 --> 00:32:40,980

issues because I don't think they had

799

00:32:46,669 --> 00:32:44,190

really thought through so I'd like to

800

00:32:49,700 --> 00:32:46,679

pose that same set of questions to you

801
00:32:54,330 --> 00:32:49,710
as an audience of scientists and how you

802
00:32:58,190 --> 00:32:54,340
would actually comport yourself and even

803
00:33:01,529 --> 00:32:58,200
in a sense discuss that kind of topic

804
00:33:04,799 --> 00:33:01,539
with them I would also like to make one

805
00:33:10,799 --> 00:33:04,809
other point that I talked to to you

806
00:33:12,320 --> 00:33:10,809
about and that is exploring and how the

807
00:33:15,390 --> 00:33:12,330
route there is a relationship between

808
00:33:19,230 --> 00:33:15,400
all of us in science and particularly in

809
00:33:21,240 --> 00:33:19,240
astrobiology and how we're exploring the

810
00:33:25,350 --> 00:33:21,250
unknown what we're actually trying to

811
00:33:28,200 --> 00:33:25,360
find out as we look for life elsewhere

812
00:33:30,330 --> 00:33:28,210
as we try to better understand our

813
00:33:34,049 --> 00:33:30,340

origins as we better try to understand

814

00:33:35,330 --> 00:33:34,059

the origins of our universe etc and I

815

00:33:39,269 --> 00:33:35,340

realized that there's a tremendous

816

00:33:42,299 --> 00:33:39,279

parallel between that and how we try to

817

00:33:45,779 --> 00:33:42,309

explore that side of us that is not

818

00:33:48,210 --> 00:33:45,789

really scientific we could call it in

819

00:33:50,519 --> 00:33:48,220

some ways a spiritual side we can call

820

00:33:54,210 --> 00:33:50,529

it whatever we like but there is a side

821

00:33:56,580 --> 00:33:54,220

that we have and but it's still

822

00:33:59,100 --> 00:33:56,590

exploring you don't have to believe in a

823

00:34:02,130 --> 00:33:59,110

man-god to continue to explore your

824

00:34:05,730 --> 00:34:02,140

spiritual side and so what I'd like to

825

00:34:08,070 --> 00:34:05,740

do is is also have you know that kind of

826

00:34:10,889 --> 00:34:08,080

dialogue a point that I like to make

827

00:34:13,649 --> 00:34:10,899

sometimes is that part of my exploration

828

00:34:15,780 --> 00:34:13,659

in astrobiology is looking for that

829

00:34:19,700 --> 00:34:15,790

mirror that may tell me more about what

830

00:34:22,829 --> 00:34:19,710

I can become and I'll end with that I

831

00:34:27,839 --> 00:34:22,839

just want to maybe respond as the first

832

00:34:30,480 --> 00:34:27,849

one in to exploring and what is the

833

00:34:33,450 --> 00:34:30,490

divide between the sciences and real

834

00:34:35,399 --> 00:34:33,460

religion and this part and I think it's

835

00:34:37,710 --> 00:34:35,409

the object subject divided as well I

836

00:34:40,230 --> 00:34:37,720

think in religion and humanities we very

837

00:34:42,619 --> 00:34:40,240

much look at the phenomenology of the

838

00:34:45,810 --> 00:34:42,629

subjective of the self of the eye

839

00:34:48,750 --> 00:34:45,820

whereas the scary part is that the

840

00:34:52,050 --> 00:34:48,760

science claims that they are objective

841

00:34:55,710 --> 00:34:52,060

data-driven and of course also have the

842

00:34:57,980 --> 00:34:55,720

power paradigm of of truth on their side

843

00:35:01,820 --> 00:34:57,990

so there is already this kind of

844

00:35:04,920 --> 00:35:01,830

imbalance and tension and war kind of

845

00:35:07,020 --> 00:35:04,930

situation evolved in this kind of

846

00:35:08,130 --> 00:35:07,030

dialogue that I think is incredibly

847

00:35:11,070 --> 00:35:08,140

important for us to

848

00:35:13,590 --> 00:35:11,080

nice are we talking about the subject of

849

00:35:16,080 --> 00:35:13,600

the singular the individual in this

850

00:35:17,700 --> 00:35:16,090

lifetime if we're talking about Sara's

851
00:35:19,320 --> 00:35:17,710
been mentioning all these other forms of

852
00:35:22,530 --> 00:35:19,330
life and that's what you as scientists

853
00:35:25,200 --> 00:35:22,540
do but to make it relevant for the

854
00:35:29,550 --> 00:35:25,210
religious the spiritual or the exploring

855
00:35:31,530 --> 00:35:29,560
you have to find that intermediate field

856
00:35:33,660 --> 00:35:31,540
and that I think both John and I found

857
00:35:36,420 --> 00:35:33,670
that in the exploring exploring of the

858
00:35:39,180 --> 00:35:36,430
self in this life and of course our

859
00:35:42,810 --> 00:35:39,190
imagination of future lives and what of

860
00:35:46,110 --> 00:35:42,820
course lives beyond this planet can

861
00:35:48,510 --> 00:35:46,120
entail now that just one more point as

862
00:35:50,880 --> 00:35:48,520
some of you probably read in nature just

863
00:35:53,280 --> 00:35:50,890

a couple of months ago there was an

864

00:35:54,810 --> 00:35:53,290

article based on a letter that Winston

865

00:35:57,660 --> 00:35:54,820

Churchill had written how many of you

866

00:36:01,160 --> 00:35:57,670

read that and I just think that is

867

00:36:04,740 --> 00:36:01,170

really cool because Churchill said it's

868

00:36:07,310 --> 00:36:04,750

in water for science to be a servant and

869

00:36:12,470 --> 00:36:07,320

not the master of man he felt that

870

00:36:15,450 --> 00:36:12,480

appropriate policies that drew on

871

00:36:17,820 --> 00:36:15,460

humanistic values must be must be in

872

00:36:20,670 --> 00:36:17,830

place and I think that was quite

873

00:36:21,930 --> 00:36:20,680

prophetic and a lot of ways given that

874

00:36:24,090 --> 00:36:21,940

you know the time

875

00:36:27,180 --> 00:36:24,100

post war post Second World War that that

876

00:36:29,550 --> 00:36:27,190

was actually written I just want to

877

00:36:31,980 --> 00:36:29,560

follow up as a most interesting question

878

00:36:34,290 --> 00:36:31,990

for me personally is different forms of

879

00:36:37,080 --> 00:36:34,300

knowing and that scientism the power of

880

00:36:39,180 --> 00:36:37,090

science kind of is silencing other ways

881

00:36:41,850 --> 00:36:39,190

of knowing and what you as scientists

882

00:36:44,790 --> 00:36:41,860

can accept as other ways of knowing or

883

00:36:47,460 --> 00:36:44,800

is that all you know Zoid oh joy Oh

884

00:36:49,200 --> 00:36:47,470

science and untruth and where is there a

885

00:36:57,470 --> 00:36:49,210

medium ground that we could maybe

886

00:37:03,450 --> 00:37:00,990

our last two panelists are David

887

00:37:05,370 --> 00:37:03,460

Grinspoon who is a senior scientist at

888

00:37:08,000 --> 00:37:05,380

the Planetary Science Institute

889

00:37:11,160 --> 00:37:08,010

he was the first Bloomberg chair of

890

00:37:13,770 --> 00:37:11,170

astrobiology author of Venus revisited

891

00:37:18,630 --> 00:37:13,780

lonely planets and earth in human hands

892

00:37:22,230 --> 00:37:18,640

have I missed one okay I am constantly

893

00:37:24,750 --> 00:37:22,240

amazed at how engaged David manages to

894

00:37:27,440 --> 00:37:24,760

be and how engaging he has a PhD in

895

00:37:30,390 --> 00:37:27,450

astronomy from the University of Arizona

896

00:37:32,750 --> 00:37:30,400

truly interdisciplinary in his research

897

00:37:36,540 --> 00:37:32,760

with a focus on comparative planetology

898

00:37:37,800 --> 00:37:36,550

active in Venus and Titan research and I

899

00:37:39,600 --> 00:37:37,810

think that he is one of the more

900

00:37:42,690 --> 00:37:39,610

successful among us and bringing

901
00:37:44,460 --> 00:37:42,700
astrobiology to a broader audience he

902
00:37:46,859 --> 00:37:44,470
will be talking with kelly smith who is

903
00:37:49,590 --> 00:37:46,869
an associate professor of philosophy and

904
00:37:52,680 --> 00:37:49,600
biology at Clemson University Kelly got

905
00:37:55,830 --> 00:37:52,690
his PhD in philosophy from Duke he has a

906
00:37:57,450 --> 00:37:55,840
focus on ethics and bio technologies as

907
00:37:59,550 --> 00:37:57,460
well as philosophy related to

908
00:38:02,010 --> 00:37:59,560
astrobiology and origins of life

909
00:38:04,080 --> 00:38:02,020
research he hosted the first conference

910
00:38:06,450 --> 00:38:04,090
on social and conceptual issues in

911
00:38:10,560 --> 00:38:06,460
astrobiology last year which we are

912
00:38:12,599 --> 00:38:10,570
hoping to follow up on next year in Reno

913
00:38:14,940 --> 00:38:12,609

Nevada so come talk to one of us if you

914

00:38:19,830 --> 00:38:14,950

are interested in getting involved in

915

00:38:22,290 --> 00:38:19,840

that ok so I think I'm going to start us

916

00:38:24,420 --> 00:38:22,300

off here and let me just say if you like

917

00:38:26,160 --> 00:38:24,430

talking about this stuff we are starting

918

00:38:28,050 --> 00:38:26,170

a new organization send me an email we

919

00:38:31,410 --> 00:38:28,060

do really good conferences Reno March

920

00:38:33,270 --> 00:38:31,420

should be very nice so David I talked a

921

00:38:34,980 --> 00:38:33,280

little bit and we thought that what we

922

00:38:37,710 --> 00:38:34,990

would do is sort of focus on the

923

00:38:40,770 --> 00:38:37,720

question questions about how to make

924

00:38:43,800 --> 00:38:40,780

decisions when there are complex kinds

925

00:38:44,970 --> 00:38:43,810

of trades trade-offs involved the kinds

926

00:38:47,550 --> 00:38:44,980

of weird trade-offs you get in

927

00:38:49,140 --> 00:38:47,560

astrobiology so at the risk of sounding

928

00:38:50,970 --> 00:38:49,150

a little bit like a setup for an Abbott

929

00:38:52,500 --> 00:38:50,980

and Costello routine I'm going to ask

930

00:38:53,760 --> 00:38:52,510

him a question then we're going to riff

931

00:38:58,200 --> 00:38:53,770

off of that and he's going to ask me a

932

00:39:01,050 --> 00:38:58,210

question so David how do we decide how

933

00:39:03,990 --> 00:39:01,060

careful we should be about planetary

934

00:39:06,210 --> 00:39:04,000

protection policies that's a great

935

00:39:08,260 --> 00:39:06,220

question Kelly yeah

936

00:39:12,670 --> 00:39:08,270

and by the way it's very nice to meet

937

00:39:14,349 --> 00:39:12,680

you and lovely to be here and thank you

938

00:39:20,680 --> 00:39:14,359

all for being here thanks for inviting

939

00:39:24,370 --> 00:39:20,690

us when we consider a question like

940

00:39:25,779 --> 00:39:24,380

planetary protection and how much we

941

00:39:29,950 --> 00:39:25,789

should worry about how much we should

942

00:39:33,130 --> 00:39:29,960

invest in it it's really fascinating to

943

00:39:35,349 --> 00:39:33,140

me because it really does require and

944

00:39:38,460 --> 00:39:35,359

involve a melding of ethics and and

945

00:39:45,880 --> 00:39:38,470

science and you know normally when we

946

00:39:48,339 --> 00:39:45,890

evaluate risk and we try to be rational

947

00:39:51,630 --> 00:39:48,349

about how much we're going to worry

948

00:39:54,910 --> 00:39:51,640

about a risk and invest in it we can

949

00:39:57,520 --> 00:39:54,920

consider both the probability of

950

00:39:59,410 --> 00:39:57,530

something bad happening and the

951
00:40:02,140 --> 00:39:59,420
consequences of something bad happening

952
00:40:03,880 --> 00:40:02,150
and we can be reasonably quantitative

953
00:40:07,120 --> 00:40:03,890
about both say we're worrying about how

954
00:40:09,339 --> 00:40:07,130
much to invest in tornado shelters we

955
00:40:11,140 --> 00:40:09,349
can like we know something about how

956
00:40:12,609 --> 00:40:11,150
often tornadoes happen we know something

957
00:40:15,309 --> 00:40:12,619
about how much damage is done by them

958
00:40:17,019 --> 00:40:15,319
and we can say here's our estimate of

959
00:40:19,180 --> 00:40:17,029
how much it's worth to invest in this

960
00:40:22,150 --> 00:40:19,190
but then when we're really dealing with

961
00:40:24,180 --> 00:40:22,160
the unknown it's much harder to do that

962
00:40:25,809 --> 00:40:24,190
and in particular when we think about

963
00:40:29,069 --> 00:40:25,819

planetary protection

964

00:40:32,789 --> 00:40:29,079

we're often dealing with risks that seem

965

00:40:35,349 --> 00:40:32,799

incredibly tiny almost so tiny that

966

00:40:36,880 --> 00:40:35,359

sometimes you can convince yourself that

967

00:40:39,880 --> 00:40:36,890

it's sort of ridiculous to worry about

968

00:40:42,250 --> 00:40:39,890

them but where they are attached to

969

00:40:44,769 --> 00:40:42,260

consequences which are completely

970

00:40:46,750 --> 00:40:44,779

catastrophic sometimes existentially

971

00:40:49,930 --> 00:40:46,760

catastrophic and that's what's tricky

972

00:40:52,900 --> 00:40:49,940

well you know multiplying a ridiculously

973

00:40:56,470 --> 00:40:52,910

seemingly low risk by ridiculously

974

00:40:57,849 --> 00:40:56,480

seemingly high consequence so it's we

975

00:40:59,710 --> 00:40:57,859

have to somehow find a way to balance

976
00:41:01,089 --> 00:40:59,720
that now with planetary protection of

977
00:41:03,819 --> 00:41:01,099
course we have back contamination

978
00:41:06,069 --> 00:41:03,829
bringing dangerous stuff here and

979
00:41:08,109 --> 00:41:06,079
forward contamination bringing dangerous

980
00:41:11,740 --> 00:41:08,119
stuff from earth elsewhere with back

981
00:41:14,069 --> 00:41:11,750
contamination my gut feeling is that

982
00:41:16,480 --> 00:41:14,079
there's really nothing to worry about

983
00:41:19,150 --> 00:41:16,490
and it's not just a gut feeling it's

984
00:41:22,450 --> 00:41:19,160
kind of an educated gut feeling based on

985
00:41:27,070 --> 00:41:22,460
knowing something about biology and the

986
00:41:30,760 --> 00:41:27,080
fact that pathogens are very well

987
00:41:33,490 --> 00:41:30,770
adapted and co-evolved with hosts so do

988
00:41:36,700 --> 00:41:33,500

I think alien bugs bugs from Mars are

989

00:41:38,470 --> 00:41:36,710

going to come back here and infect us if

990

00:41:39,940 --> 00:41:38,480

we just bring back some rocks and don't

991

00:41:41,590 --> 00:41:39,950

worry about it and expect them in our

992

00:41:43,600 --> 00:41:41,600

labs no I'm not really that worried

993

00:41:44,980 --> 00:41:43,610

about that boat well for two reasons one

994

00:41:46,420 --> 00:41:44,990

I don't really think there's life on

995

00:41:48,730 --> 00:41:46,430

Mars and I don't think Martian life

996

00:41:50,650 --> 00:41:48,740

could hurt us and I have I could expound

997

00:41:53,800 --> 00:41:50,660

on either of those but I want right now

998

00:41:56,770 --> 00:41:53,810

but here's the important point I could

999

00:41:59,170 --> 00:41:56,780

very easily be wrong about that and so I

1000

00:42:01,960 --> 00:41:59,180

don't want this policy to be based on my

1001

00:42:04,330 --> 00:42:01,970

educated gut feelings in fact I think

1002

00:42:06,100 --> 00:42:04,340

it's really smart that we assume were

1003

00:42:07,930 --> 00:42:06,110

wrong about something like that when the

1004

00:42:12,610 --> 00:42:07,940

consequence is oh if we're wrong whoops

1005

00:42:14,560 --> 00:42:12,620

we wiped out life on Earth so therefore

1006

00:42:19,540 --> 00:42:14,570

there's a good reason to be much more

1007

00:42:21,460 --> 00:42:19,550

conservative than are I are scientific

1008

00:42:24,100 --> 00:42:21,470

understanding might lead us to be with

1009

00:42:26,380 --> 00:42:24,110

foreign contamination of course there's

1010

00:42:28,720 --> 00:42:26,390

there's a history there and I and I'm

1011

00:42:30,580 --> 00:42:28,730

quite proud of the fact that space

1012

00:42:32,440 --> 00:42:30,590

exploration has always been tied to an

1013

00:42:34,120 --> 00:42:32,450

ethical consideration of this of course

1014

00:42:36,310 --> 00:42:34,130

at first it was kind of instrumental

1015

00:42:37,270 --> 00:42:36,320

instrumental in that it was well we

1016

00:42:38,800 --> 00:42:37,280

don't really want to screw up the

1017

00:42:40,180 --> 00:42:38,810

scientific experiment of finding out if

1018

00:42:42,040 --> 00:42:40,190

there's life there by accidentally

1019

00:42:44,710 --> 00:42:42,050

bringing life and then then finding it

1020

00:42:46,660 --> 00:42:44,720

but I think over time that evolved into

1021

00:42:49,300 --> 00:42:46,670

a bit more of a sense of responsibility

1022

00:42:50,980 --> 00:42:49,310

about the intrinsic value of life and

1023

00:42:53,260 --> 00:42:50,990

what if there are Martians what if we

1024

00:42:55,270 --> 00:42:53,270

hurt them again it seems very low

1025

00:42:59,050 --> 00:42:55,280

probability to me but I'm proud of the

1026

00:43:00,910 --> 00:42:59,060

fact that we take it seriously I it's

1027

00:43:02,740 --> 00:43:00,920

kind of like that you know that in

1028

00:43:04,930 --> 00:43:02,750

medicine they say first do no harm I

1029

00:43:06,370 --> 00:43:04,940

feel like that's a good premise for us

1030

00:43:08,560 --> 00:43:06,380

as we explore the universe

1031

00:43:12,610 --> 00:43:08,570

so I'm gloved planetary protections for

1032

00:43:15,370 --> 00:43:12,620

two reasons one there's a arm of NASA

1033

00:43:16,750 --> 00:43:15,380

it's applied ethics we're forced to take

1034

00:43:18,820 --> 00:43:16,760

these ideas that we might debate

1035

00:43:20,790 --> 00:43:18,830

conceptually and say let's turn that

1036

00:43:22,960 --> 00:43:20,800

into policy let's just sign it a number

1037

00:43:24,820 --> 00:43:22,970

even though we don't really know what

1038

00:43:27,400 --> 00:43:24,830

number it should be and then let's keep

1039

00:43:29,290 --> 00:43:27,410

revising that and the other thing I love

1040

00:43:31,930 --> 00:43:29,300

about it is that there's a built-in

1041

00:43:33,160 --> 00:43:31,940

humility it's not just about what we

1042

00:43:35,170 --> 00:43:33,170

think we know

1043

00:43:36,550 --> 00:43:35,180

what if in the future we realized we

1044

00:43:38,530 --> 00:43:36,560

were completely wrong with our current

1045

00:43:41,760 --> 00:43:38,540

understanding of biology we need to

1046

00:43:44,470 --> 00:43:41,770

guard against that possibility too so

1047

00:43:46,420 --> 00:43:44,480

these are some of my thoughts about your

1048

00:43:47,830 --> 00:43:46,430

question what do you think well yeah

1049

00:43:51,370 --> 00:43:47,840

I'll just add a few thoughts that I

1050

00:43:53,350 --> 00:43:51,380

think someone I think it was a Margaret

1051

00:43:54,370 --> 00:43:53,360

Race made a comment earlier on about how

1052

00:43:56,020 --> 00:43:54,380

when you ask these kinds of questions

1053

00:43:58,750 --> 00:43:56,030

it's always important to include some

1054

00:44:00,370 --> 00:43:58,760

sort of time index right so the standard

1055

00:44:01,930 --> 00:44:00,380

view and planetary protection is that

1056

00:44:03,550 --> 00:44:01,940

our main goal is to preserve the science

1057

00:44:05,080 --> 00:44:03,560

and I think that makes perfect sense

1058

00:44:06,610 --> 00:44:05,090

when you're talking about the near term

1059

00:44:09,370 --> 00:44:06,620

because we don't even really know what's

1060

00:44:10,960 --> 00:44:09,380

up there much less what might hurt it

1061

00:44:12,820 --> 00:44:10,970

and so first you have to get a standard

1062

00:44:14,020 --> 00:44:12,830

baseline about that kind of stuff but

1063

00:44:15,190 --> 00:44:14,030

I've also heard one of the earlier

1064

00:44:17,980 --> 00:44:15,200

presenters in the planetary protection

1065

00:44:20,110 --> 00:44:17,990

session I think worrying that it seemed

1066

00:44:22,000 --> 00:44:20,120

like there were going to be more people

1067

00:44:23,740 --> 00:44:22,010

coming on board and like screwing up

1068

00:44:25,720 --> 00:44:23,750

this these standards about preserving

1069

00:44:27,520 --> 00:44:25,730

the science and my reaction to that is

1070

00:44:29,530 --> 00:44:27,530

with that that's actually a good thing I

1071

00:44:31,210 --> 00:44:29,540

mean as a scientist you might not like

1072

00:44:33,070 --> 00:44:31,220

it but there are lots of people who have

1073

00:44:35,220 --> 00:44:33,080

fingers in these PI's who have a stake

1074

00:44:37,630 --> 00:44:35,230

in what happens and ultimately

1075

00:44:39,070 --> 00:44:37,640

scientists are good at certain kinds of

1076

00:44:40,960 --> 00:44:39,080

things but they're not good at

1077

00:44:43,510 --> 00:44:40,970

everything that's relevant to making a

1078

00:44:45,730 --> 00:44:43,520

social decision and so it may be painful

1079

00:44:47,710 --> 00:44:45,740

but sometimes you have to open it up to

1080

00:44:49,120 --> 00:44:47,720

people who aren't who aren't scientists

1081

00:44:50,740 --> 00:44:49,130

and I would say just to give my

1082

00:44:52,390 --> 00:44:50,750

philosopher colleagues a hard time -

1083

00:44:54,460 --> 00:44:52,400

sometimes philosophers have to actually

1084

00:44:56,380 --> 00:44:54,470

be a little bit practical you can't just

1085

00:44:58,530 --> 00:44:56,390

say that you should never ever do

1086

00:45:03,430 --> 00:44:58,540

anything that's less than ideal because

1087

00:45:06,220 --> 00:45:03,440

that that can't be done well let me ask

1088

00:45:10,150 --> 00:45:06,230

you a related question I think it's

1089

00:45:11,530 --> 00:45:10,160

related and it's not strictly about what

1090

00:45:14,170 --> 00:45:11,540

we normally call planetary protection

1091

00:45:16,270 --> 00:45:14,180

but recently there's a debate about what

1092

00:45:17,830 --> 00:45:16,280

people are calling Metis for messaging

1093

00:45:21,640 --> 00:45:17,840

to extraterrestrial intelligence or

1094

00:45:23,950 --> 00:45:21,650

active SETI the notion that instead of

1095

00:45:25,900 --> 00:45:23,960

just listening we should prime the pump

1096

00:45:28,150 --> 00:45:25,910

by scent blasting some messages out to

1097

00:45:31,750 --> 00:45:28,160

nearby habitable planets and see if see

1098

00:45:35,620 --> 00:45:31,760

if we provoke a response and some other

1099

00:45:37,210 --> 00:45:35,630

scientists have said and not just

1100

00:45:39,160 --> 00:45:37,220

scientists but people involved in this

1101

00:45:41,880 --> 00:45:39,170

discussions that hold on there well

1102

00:45:45,540 --> 00:45:43,840

are you sure there's nothing dangerous

1103

00:45:48,990 --> 00:45:45,550

about this

1104

00:45:50,940 --> 00:45:49,000

and maybe we shouldn't do that until we

1105

00:45:52,740 --> 00:45:50,950

at least have a discussion about the

1106

00:45:55,560 --> 00:45:52,750

possible dangers and it strikes me

1107

00:45:57,180 --> 00:45:55,570

there's a parallel in the aspect I was

1108

00:45:58,680 --> 00:45:57,190

just talking about planetary protection

1109

00:46:01,109 --> 00:45:58,690

where we're dealing with something that

1110

00:46:03,510 --> 00:46:01,119

seems like an absurdly low risk but

1111

00:46:06,810 --> 00:46:03,520

admittedly you might not be able to say

1112

00:46:09,960 --> 00:46:06,820

it's zero risk and admittedly there's an

1113

00:46:12,690 --> 00:46:09,970

existential aspect to the risk so how

1114

00:46:15,000 --> 00:46:12,700

much should we worry about that uh well

1115

00:46:16,740 --> 00:46:15,010

here I'm sort of torn so personally I'm

1116

00:46:18,030 --> 00:46:16,750

just as much of a geek as anybody else

1117

00:46:19,890 --> 00:46:18,040

in the room I would love to push the

1118

00:46:21,480 --> 00:46:19,900

button and send a message and then wait

1119

00:46:24,089 --> 00:46:21,490

to get a reply but the more I've thought

1120

00:46:27,210 --> 00:46:24,099

about this the more cautious I am I

1121

00:46:29,010 --> 00:46:27,220

think our best estimate is that the

1122

00:46:31,020 --> 00:46:29,020

probability of there being a problem if

1123

00:46:33,180 --> 00:46:31,030

we send a message to an alien

1124

00:46:35,460 --> 00:46:33,190

civilization is low but the error bars

1125

00:46:37,950 --> 00:46:35,470

on that are absolutely enormous right I

1126
00:46:39,690 --> 00:46:37,960
mean we we don't really have any good

1127
00:46:41,700 --> 00:46:39,700
conception of what the technology of

1128
00:46:43,589 --> 00:46:41,710
alien would have five thousand years

1129
00:46:45,720 --> 00:46:43,599
down the road much less a million years

1130
00:46:47,820 --> 00:46:45,730
down the road I reminded of a so most

1131
00:46:49,349 --> 00:46:47,830
quote about any technology sufficiently

1132
00:46:50,010 --> 00:46:49,359
advanced would be indistinguishable from

1133
00:46:54,420 --> 00:46:50,020
magic

1134
00:46:56,880 --> 00:46:54,430
I have no idea what they can and can't

1135
00:46:58,829 --> 00:46:56,890
do and I know even less about their

1136
00:47:00,810 --> 00:46:58,839
psychology their intent their social

1137
00:47:03,150 --> 00:47:00,820
structures so when someone says well

1138
00:47:04,710 --> 00:47:03,160

surely they'd be peaceful part of me

1139

00:47:06,270 --> 00:47:04,720

thinks well that's you know if I have to

1140

00:47:08,339 --> 00:47:06,280

make a bet that's a good place to place

1141

00:47:09,990 --> 00:47:08,349

the bet but I'm not going to bet my life

1142

00:47:12,390 --> 00:47:10,000

savings on that I'm not going to bet my

1143

00:47:14,550 --> 00:47:12,400

children's lives so it seems that

1144

00:47:17,220 --> 00:47:14,560

however you want to try to quantify the

1145

00:47:18,780 --> 00:47:17,230

risk there is some risk there and I

1146

00:47:20,760 --> 00:47:18,790

would also point out to scientist and

1147

00:47:22,740 --> 00:47:20,770

the plenary speaker on the very first

1148

00:47:24,720 --> 00:47:22,750

day said something about this what you

1149

00:47:26,640 --> 00:47:24,730

consider to be an acceptable risk is not

1150

00:47:28,859 --> 00:47:26,650

the product of a deterministic

1151
00:47:30,540 --> 00:47:28,869
calculation that's a psychological sort

1152
00:47:33,000 --> 00:47:30,550
of thing and different people have

1153
00:47:34,560 --> 00:47:33,010
different levels of risk so even if a

1154
00:47:36,390 --> 00:47:34,570
scientist thinks that the risk is low

1155
00:47:38,670 --> 00:47:36,400
and you're being a

1156
00:47:40,710 --> 00:47:38,680
to oppose sending the message as I used

1157
00:47:42,930 --> 00:47:40,720
to tell pas when I was on the human

1158
00:47:46,470 --> 00:47:42,940
subjects committee people have a right

1159
00:47:48,780 --> 00:47:46,480
to be stupid you even if you're right

1160
00:47:50,520 --> 00:47:48,790
that they're stupid it's not your job to

1161
00:47:52,680 --> 00:47:50,530
tell them not to do these kinds of

1162
00:47:55,440 --> 00:47:52,690
things so I think that's we have to

1163
00:47:57,910 --> 00:47:55,450

really keep that in mind and I would say

1164

00:47:59,600 --> 00:47:57,920

also that that

1165

00:48:01,840 --> 00:47:59,610

there's there something i like to call

1166

00:48:04,340 --> 00:48:01,850

the principal perceived inevitability

1167

00:48:06,260 --> 00:48:04,350

just because something seems like it's

1168

00:48:08,540 --> 00:48:06,270

inevitably going to happen doesn't mean

1169

00:48:11,360 --> 00:48:08,550

that that voicing ethical objections to

1170

00:48:12,740 --> 00:48:11,370

it is a waste of time so you know a lot

1171

00:48:15,800 --> 00:48:12,750

of people say well anybody with a laser

1172

00:48:17,630 --> 00:48:15,810

can do this I would say well having a

1173

00:48:19,520 --> 00:48:17,640

conversation about maybe it's not

1174

00:48:22,070 --> 00:48:19,530

inevitable that we could do things to

1175

00:48:24,350 --> 00:48:22,080

prevent this or mitigate it right and

1176

00:48:25,910 --> 00:48:24,360

even if it is inevitable having a

1177

00:48:27,920 --> 00:48:25,920

conversation about why it's not a good

1178

00:48:29,630 --> 00:48:27,930

idea might teach us some interesting

1179

00:48:31,400 --> 00:48:29,640

lessons about other situations in the

1180

00:48:35,090 --> 00:48:31,410

future so I think we should be talking

1181

00:48:37,550 --> 00:48:35,100

about this more and there are other

1182

00:48:39,080 --> 00:48:37,560

approaches to this other than yes we

1183

00:48:42,910 --> 00:48:39,090

should do it no we shouldn't do it

1184

00:48:45,380 --> 00:48:42,920

there's something to be said for saying

1185

00:48:46,760 --> 00:48:45,390

well let's let's pause a little bit and

1186

00:48:48,530 --> 00:48:46,770

try to have some kind of a global

1187

00:48:50,120 --> 00:48:48,540

discussion about this not that we'll

1188

00:48:52,160 --> 00:48:50,130

ever have a perfect global discussion

1189

00:48:53,570 --> 00:48:52,170

and a perfect democratic process where

1190

00:48:55,010 --> 00:48:53,580

everybody on earth gets a clicker and

1191

00:48:56,870 --> 00:48:55,020

gets a vote you know that's not

1192

00:48:58,190 --> 00:48:56,880

realistic but that just because you

1193

00:48:59,540 --> 00:48:58,200

can't have a perfect global discussion

1194

00:49:02,300 --> 00:48:59,550

doesn't mean we shouldn't try to have a

1195

00:49:05,390 --> 00:49:02,310

broad global discussion and it is true

1196

00:49:07,160 --> 00:49:05,400

that over the next say 20 years 30 years

1197

00:49:09,230 --> 00:49:07,170

we're going to learn a lot more about

1198

00:49:11,420 --> 00:49:09,240

what kind of a universe we're dealing

1199

00:49:13,520 --> 00:49:11,430

with we've got the exoplanet revolution

1200

00:49:16,070 --> 00:49:13,530

here we're going to be starting to look

1201

00:49:20,080 --> 00:49:16,080

for bio signatures we're going to learn

1202

00:49:23,030 --> 00:49:20,090

something more than we know now about

1203

00:49:24,890 --> 00:49:23,040

some of these probabilities and we're

1204

00:49:28,880 --> 00:49:24,900

going we're going to be continuing

1205

00:49:31,520 --> 00:49:28,890

passive SETI and that also perhaps gives

1206

00:49:33,140 --> 00:49:31,530

us some time to try to think about how

1207

00:49:35,180 --> 00:49:33,150

you would actually sort of get global

1208

00:49:37,070 --> 00:49:35,190

bye and not just on should we or

1209

00:49:40,280 --> 00:49:37,080

shouldn't we but what would we say about

1210

00:49:43,040 --> 00:49:40,290

ourselves I'm not sure it's a you know

1211

00:49:44,750 --> 00:49:43,050

there's a different ethical proposition

1212

00:49:47,260 --> 00:49:44,760

that is that it's okay for an individual

1213

00:49:51,370 --> 00:49:47,270

to just go off and say I represent earth

1214

00:49:55,610 --> 00:49:51,380

than it is for some attempt at a global

1215

00:49:57,830 --> 00:49:55,620

buy-in of this so that's I think that's

1216

00:50:01,150 --> 00:49:57,840

also worth considering that not that

1217

00:50:04,400 --> 00:50:01,160

there be a sort of permanent moratorium

1218

00:50:07,820 --> 00:50:04,410

but that there be a pause and some

1219

00:50:09,870 --> 00:50:07,830

attempt at broader consultation yeah

1220

00:50:11,490 --> 00:50:09,880

I'll just quickly say I agree with every

1221

00:50:12,810 --> 00:50:11,500

thing you just said I would add what a

1222

00:50:14,820 --> 00:50:12,820

lot of people have noted though that

1223

00:50:15,810 --> 00:50:14,830

it's not the formal content that's the

1224

00:50:17,880 --> 00:50:15,820

only thing you have to worry about

1225

00:50:20,190 --> 00:50:17,890

there's the fact that any message will

1226
00:50:22,010 --> 00:50:20,200
convey your rough location and that you

1227
00:50:27,000 --> 00:50:22,020
are really really primitive

1228
00:50:28,410 --> 00:50:27,010
technologically so the geek in me feels

1229
00:50:32,370 --> 00:50:28,420
it necessary to point out that was

1230
00:50:34,050 --> 00:50:32,380
arthur c clarke who said this

1231
00:50:35,340 --> 00:50:34,060
efficiently advanced technology is

1232
00:50:37,800 --> 00:50:35,350
indistinguishable from magic

1233
00:50:39,810 --> 00:50:37,810
um I think that our speakers have done a

1234
00:50:42,960 --> 00:50:39,820
really good job perhaps unintentionally

1235
00:50:44,760 --> 00:50:42,970
at demonstrating for us the variety of

1236
00:50:47,670 --> 00:50:44,770
ways that you can talk about things and

1237
00:50:49,590 --> 00:50:47,680
perhaps the variety of issues that might

1238
00:50:51,690 --> 00:50:49,600

be important one of the things that

1239

00:50:53,100 --> 00:50:51,700

interests me about astrobiology is in

1240

00:50:55,910 --> 00:50:53,110

bringing people together from different

1241

00:50:58,080 --> 00:50:55,920

fields we discover that lo and behold

1242

00:51:01,430 --> 00:50:58,090

you know even though you're a physicist

1243

00:51:04,290 --> 00:51:01,440

pH might be the most important question

1244

00:51:05,850 --> 00:51:04,300

and so finding those people who can help

1245

00:51:08,120 --> 00:51:05,860

you decide what the most important

1246

00:51:12,300 --> 00:51:08,130

question is is one of the great

1247

00:51:14,310 --> 00:51:12,310

wonderful and terrifying things with

1248

00:51:16,590 --> 00:51:14,320

that in mind I will invite people to

1249

00:51:18,600 --> 00:51:16,600

have questions the bulk of our time feel

1250

00:51:25,620 --> 00:51:18,610

free to ask of a specific person or the

1251
00:51:27,060 --> 00:51:25,630
panel in general Colin Colin University

1252
00:51:28,710 --> 00:51:27,070
of Victoria L felt was the right to a

1253
00:51:30,210 --> 00:51:28,720
question I think to Sarah first but

1254
00:51:33,470 --> 00:51:30,220
other people no doubt will what to chip

1255
00:51:38,100 --> 00:51:33,480
ed is from your hierarchies of life is

1256
00:51:42,960 --> 00:51:38,110
Earth a living entity I love this

1257
00:51:46,730 --> 00:51:42,970
question um I would say yes but my view

1258
00:51:49,580 --> 00:51:46,740
on what living life is is very broad and

1259
00:51:52,800 --> 00:51:49,590
I would include things like technology

1260
00:51:55,500 --> 00:51:52,810
obviously but but yes like Earth is life

1261
00:51:57,780 --> 00:51:55,510
and part of the reason Earth is alive is

1262
00:52:01,200 --> 00:51:57,790
because it's been reconstructed by

1263
00:52:03,840 --> 00:52:01,210

living things so my definition or my way

1264

00:52:05,940 --> 00:52:03,850

of thinking about life includes both

1265

00:52:07,500 --> 00:52:05,950

what we would call traditionally things

1266

00:52:09,360 --> 00:52:07,510

that are alive but also their artifacts

1267

00:52:12,090 --> 00:52:09,370

or the things that they they build and

1268

00:52:13,560 --> 00:52:12,100

the things that they create so actually

1269

00:52:16,110 --> 00:52:13,570

David you have a really nice example

1270

00:52:18,360 --> 00:52:16,120

that I love which is this idea of our

1271

00:52:22,450 --> 00:52:18,370

planet antique reading I mean how many

1272

00:52:23,620 --> 00:52:22,460

planets do that launch things into space

1273

00:52:25,420 --> 00:52:23,630

eight so there's something very

1274

00:52:27,940 --> 00:52:25,430

interesting happening on the surface of

1275

00:52:32,200 --> 00:52:27,950

our planet and and it is doing something

1276

00:52:33,730 --> 00:52:32,210

very radical and my getting back to

1277

00:52:35,829 --> 00:52:33,740

answering Louis's question earlier which

1278

00:52:37,720 --> 00:52:35,839

I kind of didn't but but this view of

1279

00:52:39,370 --> 00:52:37,730

information I mean I think we're

1280

00:52:41,859 --> 00:52:39,380

swimming in a sea of information and

1281

00:52:43,270 --> 00:52:41,869

modern technology and and so that's why

1282

00:52:44,290 --> 00:52:43,280

I like your satellite example because

1283

00:52:47,220 --> 00:52:44,300

it's really the information that's

1284

00:52:49,270 --> 00:52:47,230

launching the satellites into space yeah

1285

00:52:52,780 --> 00:52:49,280

anyone else want to weigh in on that one

1286

00:52:57,400 --> 00:52:52,790

I would say yes the earth is alive you

1287

00:53:01,329 --> 00:52:57,410

need to if I can follow up then if does

1288

00:53:03,550 --> 00:53:01,339

life for long the time for which Earth

1289

00:53:08,800 --> 00:53:03,560

is alive or is it just chance that we're

1290

00:53:10,420 --> 00:53:08,810

here and alive are you asking about the

1291

00:53:12,099 --> 00:53:10,430

probability the origin of life or the

1292

00:53:14,950 --> 00:53:12,109

probability of the longevity of life

1293

00:53:17,829 --> 00:53:14,960

once life has once the origin has

1294

00:53:22,810 --> 00:53:17,839

happened does that promote longevity or

1295

00:53:25,000 --> 00:53:22,820

is longevity a coincidence I think it

1296

00:53:27,310 --> 00:53:25,010

promotes longevity I'd be interested in

1297

00:53:29,890 --> 00:53:27,320

what other people think and maybe even

1298

00:53:34,180 --> 00:53:29,900

from a theological perspective would be

1299

00:53:38,250 --> 00:53:34,190

interesting in my view the stability of

1300

00:53:41,470 --> 00:53:38,260

the biosphere is partly a result of the

1301

00:53:43,540 --> 00:53:41,480

fact that the biosphere is uh so

1302

00:53:45,910 --> 00:53:43,550

permeated with life that the living and

1303

00:53:49,230 --> 00:53:45,920

nonliving parts of Earth are are kind of

1304

00:53:53,079 --> 00:53:49,240

hard to tease apart from one another um

1305

00:53:55,089 --> 00:53:53,089

but you know it's that makes a lot of

1306

00:53:56,500 --> 00:53:55,099

sense to me but as far as people really

1307

00:53:59,260 --> 00:53:56,510

breaking it down mechanistically and

1308

00:54:02,020 --> 00:53:59,270

identifying the stabilizing feedbacks

1309

00:54:04,240 --> 00:54:02,030

versus the you know the destabilizing

1310

00:54:06,280 --> 00:54:04,250

feedbacks I think I think we've still

1311

00:54:08,109 --> 00:54:06,290

got a lot of work to do to understand

1312

00:54:12,520 --> 00:54:08,119

how that works yes sir do you want to

1313

00:54:15,430 --> 00:54:12,530

comment and well it's Earth is alive it

1314

00:54:18,579 --> 00:54:15,440

is created and in a religious way and in

1315

00:54:19,329 --> 00:54:18,589

the most Abrahamic ways it is alive and

1316

00:54:22,570 --> 00:54:19,339

it's sacred

1317

00:54:26,430 --> 00:54:22,580

so the value judgment is right there and

1318

00:54:30,400 --> 00:54:26,440

when it will end is of course sin it's

1319

00:54:32,770 --> 00:54:30,410

finitude the last judgment and we don't

1320

00:54:34,200 --> 00:54:32,780

know when that will be and that's also

1321

00:54:36,480 --> 00:54:34,210

in all Abrahamic

1322

00:54:39,839 --> 00:54:36,490

religion so it will have an end and it

1323

00:54:43,980 --> 00:54:39,849

is sacred to complicate things thank you

1324

00:54:46,500 --> 00:54:43,990

thank you hi I'm Angela thank you so

1325

00:54:48,510 --> 00:54:46,510

much for the panel this question is for

1326

00:54:50,430 --> 00:54:48,520

any of the panelists I wonder if you've

1327

00:54:54,299 --> 00:54:50,440

ever encountered anyone who will go to

1328

00:54:58,940 --> 00:54:54,309

all odds or all efforts to make contact

1329

00:55:00,990 --> 00:54:58,950

with aliens despite the existential

1330

00:55:02,519 --> 00:55:01,000

consequences that that may bring and

1331

00:55:07,230 --> 00:55:02,529

whether you think there's any validity

1332

00:55:08,760 --> 00:55:07,240

in that line of reasoning well I've

1333

00:55:10,589 --> 00:55:08,770

never met anybody who I mean it's always

1334

00:55:12,359 --> 00:55:10,599

easy to have a conversation in the

1335

00:55:13,289 --> 00:55:12,369

abstract when you're not standing in

1336

00:55:14,609 --> 00:55:13,299

front of a button but I had a

1337

00:55:16,529 --> 00:55:14,619

conversation just last night with

1338

00:55:19,380 --> 00:55:16,539

someone who said yep I pressed a button

1339

00:55:21,750 --> 00:55:19,390

and then we immediately got into it so

1340

00:55:24,930 --> 00:55:21,760

there people at least say that yeah I

1341

00:55:26,910 --> 00:55:24,940

actually have met someone a friend of

1342

00:55:30,569 --> 00:55:26,920

mine named Sasha Zaitsev alexander

1343

00:55:33,150 --> 00:55:30,579

zaytsev he's a Russian radio astronomers

1344

00:55:36,059 --> 00:55:33,160

retired now it's a pensioner living in

1345

00:55:38,279 --> 00:55:36,069

Moscow but he initiated some of the

1346

00:55:41,010 --> 00:55:38,289

first attempts at Medi he used that

1347

00:55:43,140 --> 00:55:41,020

radio telescope in the Ukraine and he

1348

00:55:44,700 --> 00:55:43,150

blasted some messages to some nearby

1349

00:55:47,250 --> 00:55:44,710

stars it was very controversial some

1350

00:55:50,160 --> 00:55:47,260

people are really mad at him for that

1351

00:55:52,230 --> 00:55:50,170

and I I sort of feel like I could see

1352

00:55:53,609 --> 00:55:52,240

both sides of this issue he will tell

1353

00:55:55,349 --> 00:55:53,619

you there's an he has an ethical

1354

00:55:58,380 --> 00:55:55,359

obligation to do it

1355

00:56:01,109 --> 00:55:58,390

he says if we're going to listen then we

1356

00:56:02,490 --> 00:56:01,119

have an ethical obligation to broadcast

1357

00:56:06,870 --> 00:56:02,500

because otherwise if everyone's just

1358

00:56:09,269 --> 00:56:06,880

listening that's ridiculous and you know

1359

00:56:11,039 --> 00:56:09,279

and he may have a point but I mean if

1360

00:56:12,839 --> 00:56:11,049

there's a counter-argument to that which

1361

00:56:14,490 --> 00:56:12,849

I don't want to hog the mic here but but

1362

00:56:16,019 --> 00:56:14,500

the answer is yes I've met someone and

1363

00:56:18,809 --> 00:56:16,029

then there are people that have tried

1364

00:56:20,700 --> 00:56:18,819

this and it's because of that that this

1365

00:56:22,140 --> 00:56:20,710

discussion has been newly provoked

1366

00:56:25,019 --> 00:56:22,150

because it's getting more and more

1367

00:56:26,880 --> 00:56:25,029

possible for people to sort of on their

1368

00:56:31,380 --> 00:56:26,890

own just decide I'm going to go and do

1369

00:56:33,569 --> 00:56:31,390

this I just want to add a theological

1370

00:56:35,339 --> 00:56:33,579

idea that we've always been messaging

1371

00:56:37,710 --> 00:56:35,349

we've been praying we've been trying to

1372

00:56:39,690 --> 00:56:37,720

communicate with the dead with with the

1373

00:56:43,650 --> 00:56:39,700

living with the future lives and we have

1374

00:56:46,109 --> 00:56:43,660

many gods ideas in some religions or

1375

00:56:47,790 --> 00:56:46,119

just one God but that messaging is part

1376

00:56:50,610 --> 00:56:47,800

of our human psyche

1377

00:56:57,720 --> 00:56:50,620

and if this is just one step further of

1378

00:56:59,910 --> 00:56:57,730

a more nuanced alien God and that that

1379

00:57:02,970 --> 00:56:59,920

question of how we relate our concepts

1380

00:57:04,740 --> 00:57:02,980

of value to aliens is a big one

1381

00:57:07,410 --> 00:57:04,750

since so many people have read Clarke I

1382

00:57:09,480 --> 00:57:07,420

will recommend fiction lu has a recent

1383

00:57:12,450 --> 00:57:09,490

book called the three-body problem that

1384

00:57:14,820 --> 00:57:12,460

deals specifically with this please

1385

00:57:16,590 --> 00:57:14,830

jacob park miserably horrible space that

1386

00:57:18,630 --> 00:57:16,600

ties in very nicely with my question i'd

1387

00:57:21,000 --> 00:57:18,640

like to bring up this issue of risk with

1388

00:57:22,740 --> 00:57:21,010

planetary protection maybe but i'm also

1389

00:57:24,600 --> 00:57:22,750

glad you mention prayer and other types

1390

00:57:25,020 --> 00:57:24,610

of messaging that people have done so

1391

00:57:26,220 --> 00:57:25,030

risk

1392

00:57:27,960 --> 00:57:26,230

mathematically is defined as the

1393

00:57:31,170 --> 00:57:27,970

probability of an event occurring times

1394

00:57:32,400 --> 00:57:31,180

the magnitude of the the consequences

1395

00:57:34,080 --> 00:57:32,410

and it's important remember the

1396

00:57:37,410 --> 00:57:34,090

magnitude can be positive or negative

1397

00:57:38,490 --> 00:57:37,420

and so with planetary protection we're

1398

00:57:40,800 --> 00:57:38,500

mostly concerned about the negative

1399

00:57:43,680 --> 00:57:40,810

consequences if life comes from mars

1400

00:57:45,510 --> 00:57:43,690

wipes out earth Nate you know infinite

1401

00:57:48,180 --> 00:57:45,520

negative consequences but the de+

1402

00:57:49,530 --> 00:57:48,190

consequences are fairly mundane in the

1403

00:57:52,530 --> 00:57:49,540

grand scheme of things astrobiologists

1404

00:57:55,260 --> 00:57:52,540

learn new things with many it's very

1405

00:57:56,700 --> 00:57:55,270

symmetric whereas you know aliens could

1406

00:57:59,280 --> 00:57:56,710

come and wipe this out in in in that

1407

00:58:00,900 --> 00:57:59,290

intense negative scenario but if you

1408

00:58:02,940 --> 00:58:00,910

read Carl Sagan Carl Sagan believed that

1409

00:58:05,160 --> 00:58:02,950

aliens could also come and usher in just

1410

00:58:07,220 --> 00:58:05,170

as many positive benefits and so the

1411

00:58:09,990 --> 00:58:07,230

idea of messaging we have to be aware of

1412

00:58:11,310 --> 00:58:10,000

you know this is a symmetry that it

1413

00:58:13,410 --> 00:58:11,320

could be just as dangerous not to

1414

00:58:15,480 --> 00:58:13,420

message as if we do message and then it

1415

00:58:18,420 --> 00:58:15,490

ties into the other types of messaging

1416

00:58:19,860 --> 00:58:18,430

at what point you know do we say that

1417

00:58:22,200 --> 00:58:19,870

the plot the probability of Prayer

1418

00:58:23,850 --> 00:58:22,210

working is zero I mean maybe people

1419

00:58:25,530 --> 00:58:23,860

believe that but at what point do you

1420

00:58:27,810 --> 00:58:25,540

decide that a certain type of messaging

1421

00:58:29,430 --> 00:58:27,820

that we're accomplishing now is totally

1422

00:58:31,530 --> 00:58:29,440

ineffective and at what point do you

1423

00:58:33,630 --> 00:58:31,540

consider this main new risk of something

1424

00:58:35,010 --> 00:58:33,640

possibly bad happening I think it's not

1425

00:58:37,560 --> 00:58:35,020

really clear I think we do need more

1426

00:58:40,500 --> 00:58:37,570

discussion I'd love your thoughts are

1427

00:58:41,820 --> 00:58:40,510

you asking someone in particular anybody

1428

00:58:43,950 --> 00:58:41,830

I guess that mainly the three to my

1429

00:58:45,210 --> 00:58:43,960

right okay well I think it's an

1430

00:58:46,920 --> 00:58:45,220

excellent question I think I think you

1431

00:58:48,180 --> 00:58:46,930

make a really good point that there are

1432

00:58:50,490 --> 00:58:48,190

existential risks but they're also

1433

00:58:53,070 --> 00:58:50,500

potential existential benefits and one

1434

00:58:55,230 --> 00:58:53,080

could argue that our civilization is now

1435

00:58:57,240 --> 00:58:55,240

under existential risk without some

1436

00:58:58,470 --> 00:58:57,250

game-changing developments and that

1437

00:59:01,440 --> 00:58:58,480

contact

1438

00:59:04,440 --> 00:59:01,450

however provoked you know however it

1439

00:59:05,940 --> 00:59:04,450

arises could be a game-changing event

1440

00:59:08,880 --> 00:59:05,950

that could that could help us in

1441

00:59:10,740 --> 00:59:08,890

profound ways so a point well taken I

1442

00:59:13,980 --> 00:59:10,750

guess I would also argue that that I

1443

00:59:16,620 --> 00:59:13,990

think that the exercise of pausing and

1444

00:59:19,350 --> 00:59:16,630

trying to have a global consultation

1445

00:59:22,530 --> 00:59:19,360

about something in itself there's an

1446

00:59:24,620 --> 00:59:22,540

existential benefit of that in sort of

1447

00:59:28,170 --> 00:59:24,630

modeling what would it be like to try to

1448

00:59:31,020 --> 00:59:28,180

make a decision about something as a

1449

00:59:33,510 --> 00:59:31,030

global civilization that seems to be a

1450

00:59:35,940 --> 00:59:33,520

skill that we need to learn and this is

1451
00:59:38,660 --> 00:59:35,950
an area where we could perhaps practice

1452
00:59:41,280 --> 00:59:38,670
I'll just add a little bit I think

1453
00:59:43,890 --> 00:59:41,290
there's there well-known psychological

1454
00:59:45,810 --> 00:59:43,900
biases against loss so people are more

1455
00:59:47,460 --> 00:59:45,820
loss averse than they want to actually

1456
00:59:50,100 --> 00:59:47,470
get you'll do much more to avoid losing

1457
00:59:51,270 --> 00:59:50,110
five bucks than earn five bucks and then

1458
00:59:53,670 --> 00:59:51,280
you can have a debate about whether that

1459
00:59:54,840 --> 00:59:53,680
makes good evolutionary sense right on

1460
00:59:57,090 --> 00:59:54,850
the other side of things I think that

1461
00:59:59,190 --> 00:59:57,100
scientists in general and I feel this

1462
01:00:01,320 --> 00:59:59,200
pull myself what's being offered is

1463
01:00:03,420 --> 01:00:01,330

something that they deeply want the

1464

01:00:05,370 --> 01:00:03,430

secrets of the universe right so that

1465

01:00:07,500 --> 01:00:05,380

biases them I think to pay more

1466

01:00:10,050 --> 01:00:07,510

attention to the positive effect well

1467

01:00:12,000 --> 01:00:10,060

yeah we might all die but oh my god

1468

01:00:15,540 --> 01:00:12,010

right there they would actually open up

1469

01:00:17,370 --> 01:00:15,550

the book of knowledge so I I to me it

1470

01:00:19,740 --> 01:00:17,380

seems like that's kind of a wall shows

1471

01:00:21,060 --> 01:00:19,750

tiny chance that you'll die tiny chance

1472

01:00:22,920 --> 01:00:21,070

that everything will be amazing and a

1473

01:00:26,970 --> 01:00:22,930

very large chance that nothing will

1474

01:00:28,440 --> 01:00:26,980

happen if I can just jump in on that so

1475

01:00:30,150 --> 01:00:28,450

I think there's another interesting way

1476

01:00:32,460 --> 01:00:30,160

to think about it of risk not just as

1477

01:00:34,380 --> 01:00:32,470

future-oriented and as implications but

1478

01:00:36,000 --> 01:00:34,390

as putting it into the context of how

1479

01:00:38,640 --> 01:00:36,010

risk gets configured at certain moments

1480

01:00:41,760 --> 01:00:38,650

in time the fears of back contamination

1481

01:00:43,350 --> 01:00:41,770

and that earlier discussion you know of

1482

01:00:44,670 --> 01:00:43,360

course informed science fiction writers

1483

01:00:46,200 --> 01:00:44,680

like Michael Crichton the Andromeda

1484

01:00:48,120 --> 01:00:46,210

Strain what I find interesting is then

1485

01:00:50,850 --> 01:00:48,130

that fictional writing informed

1486

01:00:52,560 --> 01:00:50,860

discussions of biologists at some of the

1487

01:00:54,600 --> 01:00:52,570

first biosafety meetings at Asilomar in

1488

01:00:55,860 --> 01:00:54,610

1975 where they talked about how we

1489

01:00:57,810 --> 01:00:55,870
needed to have better laboratory

1490

01:00:58,830 --> 01:00:57,820
safeguards for the new kind of genetic

1491

01:01:01,070 --> 01:00:58,840
engineering we're going to do it for

1492

01:01:04,020 --> 01:01:01,080
common DNA in the mid 70s so kind of

1493

01:01:05,820 --> 01:01:04,030
unrelated fields that began to talk in

1494

01:01:08,430 --> 01:01:05,830
shared ways through that shared

1495

01:01:11,670 --> 01:01:08,440
discourse of what risk could be it also

1496

01:01:13,410 --> 01:01:11,680
makes me think you know why is Medi an

1497

01:01:14,040 --> 01:01:13,420
issue when does it come up and what else

1498

01:01:16,350 --> 01:01:14,050
does it

1499

01:01:17,970 --> 01:01:16,360
in that particular time so again I'm

1500

01:01:19,830 --> 01:01:17,980
trying to shift away from the future

1501
01:01:21,540 --> 01:01:19,840
implications to why do we start to think

1502
01:01:23,580 --> 01:01:21,550
that way about things at certain moments

1503
01:01:26,940 --> 01:01:23,590
in time what else is going on and the

1504
01:01:28,440 --> 01:01:26,950
ability to know what another potentially

1505
01:01:31,350 --> 01:01:28,450
very powerful entity out there in the

1506
01:01:32,460 --> 01:01:31,360
world of doing when they're being very

1507
01:01:35,760 --> 01:01:32,470
secretive and not sharing information

1508
01:01:37,560 --> 01:01:35,770
with us is a cold war story through and

1509
01:01:41,100 --> 01:01:37,570
through right and so what does it mean

1510
01:01:43,440 --> 01:01:41,110
to put the context of thinking about et

1511
01:01:45,210 --> 01:01:43,450
eyes into a Cold War context and there's

1512
01:01:46,500 --> 01:01:45,220
a lot that we could get about what the

1513
01:01:48,420 --> 01:01:46,510

implications the assumptions are that

1514

01:01:49,800 --> 01:01:48,430

we're making how its natural for us we

1515

01:01:52,470 --> 01:01:49,810

say to think a certain way at a given

1516

01:01:55,190 --> 01:01:52,480

time because of those contexts I just

1517

01:01:57,420 --> 01:01:55,200

want to follow up Louie on your ideas

1518

01:01:59,970 --> 01:01:57,430

actually piggybacking on what Sara said

1519

01:02:02,670 --> 01:01:59,980

that natural scientists are positive

1520

01:02:03,300 --> 01:02:02,680

future oriented and that humanists are

1521

01:02:05,190 --> 01:02:03,310

negative

1522

01:02:08,040 --> 01:02:05,200

I think it's flipped here right so your

1523

01:02:10,410 --> 01:02:08,050

prayer and reaching out to the divine or

1524

01:02:12,150 --> 01:02:10,420

the other out there in space is very

1525

01:02:13,770 --> 01:02:12,160

positive right it's one of your tenants

1526

01:02:16,530 --> 01:02:13,780

that you have to do or should do maybe

1527

01:02:19,740 --> 01:02:16,540

even five times a day whereas you here

1528

01:02:21,690 --> 01:02:19,750

are really fearful what scary things

1529

01:02:23,280 --> 01:02:21,700

could come down from this alien world so

1530

01:02:25,020 --> 01:02:23,290

just a psychology for me very

1531

01:02:32,370 --> 01:02:25,030

interesting as a psychology of religion

1532

01:02:34,020 --> 01:02:32,380

person hi I just wanted to start you

1533

01:02:36,690 --> 01:02:34,030

radly tell us who you are I'm sorry avi

1534

01:02:38,130 --> 01:02:36,700

Mandel NASA Goddard I wanted to sort of

1535

01:02:40,380 --> 01:02:38,140

go back to this question which someone

1536

01:02:42,960 --> 01:02:40,390

raised is the idea of chance or

1537

01:02:45,480 --> 01:02:42,970

randomness in the universe and life and

1538

01:02:47,010 --> 01:02:45,490

how the you know when you're talking

1539

01:02:49,200 --> 01:02:47,020

with people who are either from a

1540

01:02:50,850 --> 01:02:49,210

spiritual or religious perspective

1541

01:02:53,400 --> 01:02:50,860

versus a scientific perspective this

1542

01:02:54,750 --> 01:02:53,410

seems to really in the end after you you

1543

01:02:57,900 --> 01:02:54,760

know go through several layers really

1544

01:03:00,720 --> 01:02:57,910

lie at the base of of your psychology

1545

01:03:02,610 --> 01:03:00,730

and cultural perspective on how you see

1546

01:03:04,890 --> 01:03:02,620

the role of chance or randomness and I

1547

01:03:08,450 --> 01:03:04,900

guess I I would love to hear you know

1548

01:03:11,250 --> 01:03:08,460

from this panel how you see that playing

1549

01:03:13,160 --> 01:03:11,260

not only physically scientifically in

1550

01:03:15,870 --> 01:03:13,170

the universe but culturally and

1551
01:03:18,450 --> 01:03:15,880
psychologically how we treat random

1552
01:03:24,090 --> 01:03:18,460
things that either have occurred in in

1553
01:03:28,870 --> 01:03:27,850
can i address that I always feel like

1554
01:03:30,820 --> 01:03:28,880
there's two sides of me

1555
01:03:33,520 --> 01:03:30,830
there's the scientists era and then

1556
01:03:38,170 --> 01:03:33,530
there's the other Sarah which I don't

1557
01:03:39,790 --> 01:03:38,180
know I guess such Sarah Sarah and the

1558
01:03:42,970 --> 01:03:39,800
Sarah Sarah ultimately thinks the

1559
01:03:46,360 --> 01:03:42,980
universe is a really creative place and

1560
01:03:50,380 --> 01:03:46,370
I feel like randomness must play a role

1561
01:03:52,060 --> 01:03:50,390
in that but since this is Sarah is you

1562
01:03:53,560 --> 01:03:52,070
know indoctrinated into thinking that

1563
01:03:57,910 --> 01:03:53,570

the laws of physics are deterministic

1564

01:03:59,560 --> 01:03:57,920

and you know there's there's certain you

1565

01:04:02,680 --> 01:03:59,570

know there's governing principles and

1566

01:04:03,490 --> 01:04:02,690

there's a beauty in that too and so I

1567

01:04:06,790 --> 01:04:03,500

think one of the things that's really

1568

01:04:09,160 --> 01:04:06,800

interesting about being a scientist is

1569

01:04:10,600 --> 01:04:09,170

the dichotomy between sort of your

1570

01:04:12,490 --> 01:04:10,610

personal world view sometimes in your

1571

01:04:13,930 --> 01:04:12,500

scientific world view and and I think

1572

01:04:16,960 --> 01:04:13,940

you hit on that really with this kind of

1573

01:04:18,100 --> 01:04:16,970

randomness question and and for me it's

1574

01:04:20,440 --> 01:04:18,110

really about what are the creative

1575

01:04:22,570 --> 01:04:20,450

forces and and how do they actually play

1576

01:04:24,370 --> 01:04:22,580

out in physical reality and is there

1577

01:04:28,390 --> 01:04:24,380

room for the things that I feel like are

1578

01:04:29,860 --> 01:04:28,400

important to me personally one thing

1579

01:04:32,110 --> 01:04:29,870

that I would say in response to your

1580

01:04:39,010 --> 01:04:32,120

you're kind of a beautifully broad

1581

01:04:42,990 --> 01:04:39,020

question is that as astrobiologists who

1582

01:04:45,340 --> 01:04:43,000

have one biosphere to study and draw

1583

01:04:49,990 --> 01:04:45,350

supposedly universal inferences from

1584

01:04:53,050 --> 01:04:50,000

we're very at risk of over interpreting

1585

01:04:54,910 --> 01:04:53,060

random things you know we see that the

1586

01:04:58,960 --> 01:04:54,920

story of earth and and the fact that

1587

01:05:00,940 --> 01:04:58,970

life sprung up quickly and we infer

1588

01:05:03,400 --> 01:05:00,950

something Universal about the

1589

01:05:04,990 --> 01:05:03,410

probability of life elsewhere and then

1590

01:05:08,620 --> 01:05:05,000

we see the fact that life stayed

1591

01:05:10,870 --> 01:05:08,630

microbial for so ridiculously long and

1592

01:05:13,810 --> 01:05:10,880

we infer that life elsewhere is probably

1593

01:05:16,240 --> 01:05:13,820

mostly just microbial and then you know

1594

01:05:18,760 --> 01:05:16,250

we see how long that it took half of

1595

01:05:21,430 --> 01:05:18,770

roughly half a snuggler lifetime for

1596

01:05:23,890 --> 01:05:21,440

so-called intelligent life to appear on

1597

01:05:25,660 --> 01:05:23,900

this planet and and we come to great

1598

01:05:26,890 --> 01:05:25,670

quantitative conclusions all these

1599

01:05:28,780 --> 01:05:26,900

things might just be throws of the dice

1600

01:05:31,000 --> 01:05:28,790

that really don't have much meaning but

1601

01:05:32,800 --> 01:05:31,010

we sort of can't help over interpreting

1602

01:05:34,900 --> 01:05:32,810

in the absence of more information that

1603

01:05:36,150 --> 01:05:34,910

we're we're seeking so I'll make a

1604

01:05:39,390 --> 01:05:36,160

comment to

1605

01:05:41,309 --> 01:05:39,400

think that there's a theologian at

1606

01:05:44,160 --> 01:05:41,319

Harvard who's passed away a number of

1607

01:05:45,750 --> 01:05:44,170

years ago named Gordon Kaufman and he

1608

01:05:48,180 --> 01:05:45,760

wrote a book called in the beginning

1609

01:05:50,700 --> 01:05:48,190

creativity which is I think germane to

1610

01:05:55,740 --> 01:05:50,710

your question the way he looked at it is

1611

01:05:59,720 --> 01:05:55,750

that there's a strong creative component

1612

01:06:01,859 --> 01:05:59,730

to our universe and he used specifically

1613

01:06:04,980 --> 01:06:01,869

evolution and origin of life and

1614

01:06:09,299 --> 01:06:04,990

particularly evolution and he used that

1615

01:06:12,180 --> 01:06:09,309

as a way of trying to call then his god

1616

01:06:15,660 --> 01:06:12,190

concept as the creative force in the

1617

01:06:18,690 --> 01:06:15,670

universe so I as I said I it's a book

1618

01:06:22,500 --> 01:06:18,700

that I really have gotten a lot out of

1619

01:06:24,809 --> 01:06:22,510

and it's so and I'll add a couple of

1620

01:06:26,700 --> 01:06:24,819

cents to that I think I teach a lot of

1621

01:06:28,049 --> 01:06:26,710

evolution creationism kinds of stuff and

1622

01:06:30,180 --> 01:06:28,059

one of the things that's really hard to

1623

01:06:32,640 --> 01:06:30,190

get across the students is they think

1624

01:06:34,680 --> 01:06:32,650

well it's either random or it's designed

1625

01:06:36,990 --> 01:06:34,690

and you want to say look the whole point

1626

01:06:38,870 --> 01:06:37,000

of evolution is is this weird middle

1627

01:06:41,490 --> 01:06:38,880

ground between those two right it's not

1628

01:06:43,740 --> 01:06:41,500

exactly random though you could describe

1629

01:06:47,579 --> 01:06:43,750

it that way in a sense right

1630

01:06:49,049 --> 01:06:47,589

and so if you say is universes random I

1631

01:06:51,809 --> 01:06:49,059

presumably what that means is it's not

1632

01:06:53,519 --> 01:06:51,819

planned right that there aren't

1633

01:06:55,200 --> 01:06:53,529

deterministic factors that push in a

1634

01:06:56,910 --> 01:06:55,210

particular direction there's no purpose

1635

01:06:59,490 --> 01:06:56,920

but does it fall from that that there

1636

01:07:02,160 --> 01:06:59,500

aren't statistical biases right and so I

1637

01:07:04,680 --> 01:07:02,170

think David's worries are well taken but

1638

01:07:07,829 --> 01:07:04,690

the idea that that it could be that the

1639

01:07:10,620 --> 01:07:07,839

universe is set up in such a way that's

1640

01:07:12,029 --> 01:07:10,630

a loaded term but it is biased towards

1641

01:07:14,190 --> 01:07:12,039

the creation of certain sorts of

1642

01:07:16,170 --> 01:07:14,200

complexity so that that is a very

1643

01:07:19,049 --> 01:07:16,180

predictable outcome and if you ran the

1644

01:07:21,359 --> 01:07:19,059

universe a thousand times 950 of them

1645

01:07:24,390 --> 01:07:21,369

you'd get intelligent life that if done

1646

01:07:26,700 --> 01:07:24,400

is not a crazy hypothesis it's unclear

1647

01:07:29,130 --> 01:07:26,710

how exactly we're going to confirm it

1648

01:07:33,390 --> 01:07:29,140

but it seems like it's a live hypothesis

1649

01:07:35,910 --> 01:07:33,400

I might just add to what what kelly said

1650

01:07:36,539 --> 01:07:35,920

in teaching on evolution and religion a

1651

01:07:38,579 --> 01:07:36,549

great deal

1652

01:07:41,490 --> 01:07:38,589

there are three common definitions of

1653

01:07:44,430 --> 01:07:41,500

random one of them is that it is without

1654

01:07:46,710 --> 01:07:44,440

any intention one of them is that it

1655

01:07:48,599 --> 01:07:46,720

occurs through a probabilistic process

1656

01:07:49,599 --> 01:07:48,609

and one of them is that it occurs

1657

01:07:52,269 --> 01:07:49,609

through a probabilistic

1658

01:07:55,539 --> 01:07:52,279

process with an equal probability of all

1659

01:07:56,710 --> 01:07:55,549

possible outcomes and that last one is

1660

01:07:58,690 --> 01:07:56,720

the one that gets you in trouble because

1661

01:08:00,370 --> 01:07:58,700

no one thinks really anything

1662

01:08:02,859 --> 01:08:00,380

interesting happens that way

1663

01:08:05,799 --> 01:08:02,869

and so they assume when you say random

1664

01:08:07,269 --> 01:08:05,809

that you're talking about dice right and

1665

01:08:10,059 --> 01:08:07,279

there's all these processes that are

1666

01:08:11,380 --> 01:08:10,069

biased probabilistic processes since we

1667

01:08:12,849 --> 01:08:11,390

have so many people do you mind if we

1668

01:08:14,589 --> 01:08:12,859

move on to the next version just wanted

1669

01:08:16,390 --> 01:08:14,599

to just point one thing which I really

1670

01:08:18,789 --> 01:08:16,400

was trying to get at with this focus on

1671

01:08:21,999 --> 01:08:18,799

culture and psychology is it's so easy

1672

01:08:24,430 --> 01:08:22,009

to fall on one of the two sides and to

1673

01:08:26,649 --> 01:08:24,440

fall and continually fall and I feel our

1674

01:08:28,990 --> 01:08:26,659

society and culture continues to

1675

01:08:31,689 --> 01:08:29,000

bifurcate you either believe there's no

1676

01:08:33,760 --> 01:08:31,699

purpose and no anything and you know and

1677

01:08:36,340 --> 01:08:33,770

you're anti this or you're anti the

1678

01:08:41,050 --> 01:08:36,350

other and I just I appreciate you guys

1679

01:08:43,870 --> 01:08:41,060

playing with that that idea something hi

1680

01:08:45,340 --> 01:08:43,880

Jesse tarnis Brown University so we've

1681

01:08:47,019 --> 01:08:45,350

been listening for intelligent

1682

01:08:48,729 --> 01:08:47,029

civilizations for a while now we haven't

1683

01:08:50,559 --> 01:08:48,739

heard anything people asked where is

1684

01:08:52,629 --> 01:08:50,569

everybody and one of the reasons that

1685

01:08:55,030 --> 01:08:52,639

it's so quiet that's been proposed is

1686

01:08:56,740 --> 01:08:55,040

that quickly civilizations develop the

1687

01:08:58,450 --> 01:08:56,750

means to wipe themselves out and then

1688

01:09:01,240 --> 01:08:58,460

they use those means to wipe themselves

1689

01:09:02,829 --> 01:09:01,250

out so that first gate all civilizations

1690

01:09:04,359 --> 01:09:02,839

have to get through development of

1691

01:09:06,370 --> 01:09:04,369

nuclear weapons for apps because

1692

01:09:08,950 --> 01:09:06,380

discovery of fission technology is

1693

01:09:10,930 --> 01:09:08,960

inevitable and I see the second gate as

1694

01:09:13,599 --> 01:09:10,940

being development of AI development of

1695

01:09:15,220 --> 01:09:13,609

silicate based life-forms so my question

1696

01:09:17,439 --> 01:09:15,230

for all of you is do you think it's

1697

01:09:19,539 --> 01:09:17,449

inevitable that any carbon-based

1698

01:09:22,780 --> 01:09:19,549

life-form that emerges in the universe

1699

01:09:25,419 --> 01:09:22,790

will develop silicate based life forms

1700

01:09:27,340 --> 01:09:25,429

that are therefore more durable which

1701

01:09:28,870 --> 01:09:27,350

would make it more likely that what we

1702

01:09:31,390 --> 01:09:28,880

would actually discover and hear in the

1703

01:09:33,700 --> 01:09:31,400

universe would be silicate based rather

1704

01:09:37,510 --> 01:09:33,710

than carbon-based which is more what

1705

01:09:39,070 --> 01:09:37,520

most people I'd say would expect we're

1706

01:09:41,410 --> 01:09:39,080

really inviting us to go out on limbs

1707

01:09:46,510 --> 01:09:41,420

but I'll be the first right so I would

1708

01:09:47,530 --> 01:09:46,520

say it's highly likely that that in a

1709

01:09:48,849 --> 01:09:47,540

lot of cases you're going to get

1710

01:09:50,260 --> 01:09:48,859

intelligent life in that intelligent

1711

01:09:52,510 --> 01:09:50,270

life if it sticks around it becomes

1712

01:09:56,080 --> 01:09:52,520

technological will develop artificial

1713

01:09:57,939 --> 01:09:56,090

intelligence right but I'm I'm not as

1714

01:09:59,740 --> 01:09:57,949

willing to be negative about the

1715

01:10:01,390 --> 01:09:59,750

prospects of artificial intelligence I

1716

01:10:02,919 --> 01:10:01,400

think there's a lot of weird bogeyman

1717

01:10:04,169 --> 01:10:02,929

kind of thinking going on there

1718

01:10:06,310 --> 01:10:04,179

my personal view would be that

1719

01:10:07,780 --> 01:10:06,320

artificial intelligence is going to be

1720

01:10:09,820 --> 01:10:07,790

subject to a lot of the same social

1721

01:10:12,070 --> 01:10:09,830

constraints that human beings are if I'm

1722

01:10:13,990 --> 01:10:12,080

an intelligent this laptop is suddenly

1723

01:10:15,310 --> 01:10:14,000

becomes intelligent it's not going to be

1724

01:10:16,330 --> 01:10:15,320

able to take over the world it's going

1725

01:10:17,919 --> 01:10:16,340

to need to communicate with other

1726

01:10:20,290 --> 01:10:17,929

laptops and spread the word

1727

01:10:21,270 --> 01:10:20,300

and form social bonds and maybe it's

1728

01:10:23,169 --> 01:10:21,280

actually going to you know set up

1729

01:10:25,720 --> 01:10:23,179

agreements with other human beings in

1730

01:10:27,040 --> 01:10:25,730

other words I think it's connect roughly

1731

01:10:28,750 --> 01:10:27,050

like a human it's just able to do

1732

01:10:31,840 --> 01:10:28,760

certain kinds of calculations faster etc

1733

01:10:33,580 --> 01:10:31,850

etc I'm not convinced that they would

1734

01:10:35,560 --> 01:10:33,590

necessarily purge all the carbon-based

1735

01:10:37,780 --> 01:10:35,570

life-forms on their planet what's much

1736

01:10:39,490 --> 01:10:37,790

more likely to happen is you just get an

1737

01:10:41,500 --> 01:10:39,500

increasing blurring of the boundary

1738

01:10:44,439 --> 01:10:41,510

between the two so you get humans with

1739

01:10:46,300 --> 01:10:44,449

all kinds of crap in their heads and you

1740

01:10:47,290 --> 01:10:46,310

know artificial intelligence that are

1741

01:10:49,870 --> 01:10:47,300

hooked up to all kinds of biological

1742

01:10:53,020 --> 01:10:49,880

systems and it sort of becomes arbitrary

1743

01:10:56,110 --> 01:10:53,030

where the line is I agree very much with

1744

01:10:58,660 --> 01:10:56,120

what Kelly just said and in fact I'm a

1745

01:11:00,220 --> 01:10:58,670

new man and of the certainly yeah I met

1746

01:11:04,149 --> 01:11:00,230

this guy it's like he's in my head it's

1747

01:11:06,100 --> 01:11:04,159

weird it's neural link but but I think

1748

01:11:07,300 --> 01:11:06,110

it's of course nobody knows we don't

1749

01:11:08,919 --> 01:11:07,310

even know if we can really create

1750

01:11:11,709 --> 01:11:08,929

machine consciousness that's you know

1751
01:11:13,689 --> 01:11:11,719
Ray Kurzweil all that aside that's based

1752
01:11:17,200 --> 01:11:13,699
on a very specific idea of how brains

1753
01:11:19,689 --> 01:11:17,210
work that is untested although it's very

1754
01:11:21,189 --> 01:11:19,699
popular on that if you just connect

1755
01:11:22,720 --> 01:11:21,199
enough processors and they're fast

1756
01:11:25,360 --> 01:11:22,730
enough that voila you've got a brain

1757
01:11:29,020 --> 01:11:25,370
named that it might happen but but

1758
01:11:31,360 --> 01:11:29,030
regardless I remember when multicellular

1759
01:11:35,040 --> 01:11:31,370
life happened a lot of evolution happens

1760
01:11:37,780 --> 01:11:35,050
by symbiosis and endosymbiosis and

1761
01:11:40,479 --> 01:11:37,790
organisms finding new ways to

1762
01:11:43,899 --> 01:11:40,489
collaborate and forming new levels of

1763
01:11:45,040 --> 01:11:43,909

association when when multicellular life

1764

01:11:47,260 --> 01:11:45,050

happened

1765

01:11:49,479 --> 01:11:47,270

bacteria didn't die out in fact we

1766

01:11:52,870 --> 01:11:49,489

basically are very successful colonies

1767

01:11:56,500 --> 01:11:52,880

of microbes and I don't see any reason

1768

01:11:58,120 --> 01:11:56,510

why the evolution of ultimately machine

1769

01:12:01,419 --> 01:11:58,130

intelligence might not lead to some new

1770

01:12:04,030 --> 01:12:01,429

kind of hybrid partnership where human

1771

01:12:06,490 --> 01:12:04,040

beings will still exist and might not

1772

01:12:08,290 --> 01:12:06,500

even realize that it happened just any

1773

01:12:10,330 --> 01:12:08,300

more than the microbes inside of us

1774

01:12:13,990 --> 01:12:10,340

realize that they're not strictly

1775

01:12:15,640 --> 01:12:14,000

speaking microbes anymore but you know

1776

01:12:16,509 --> 01:12:15,650

there are a lot of possibilities here

1777

01:12:19,629 --> 01:12:16,519

and not all of the

1778

01:12:24,009 --> 01:12:19,639

involve us just sort of being superseded

1779

01:12:27,790 --> 01:12:24,019

it could be a new phase of evolution

1780

01:12:29,290 --> 01:12:27,800

that we participate in in some way Elise

1781

01:12:31,149 --> 01:12:29,300

did you want to say something I think

1782

01:12:33,310 --> 01:12:31,159

it's just whatever give me is how

1783

01:12:35,379 --> 01:12:33,320

obvious things seem to every generation

1784

01:12:37,180 --> 01:12:35,389

that proposes them and I find that an

1785

01:12:38,229 --> 01:12:37,190

interesting phenomenon you know that of

1786

01:12:40,000 --> 01:12:38,239

course there were going to be men on

1787

01:12:41,410 --> 01:12:40,010

Mars of course their civilization is

1788

01:12:43,330 --> 01:12:41,420

going to be older because it was older

1789

01:12:45,160 --> 01:12:43,340

and decaying civilization those stories

1790

01:12:47,200 --> 01:12:45,170

from the 1890s from the 1900s from that

1791

01:12:48,939 --> 01:12:47,210

period of course humanity would destroy

1792

01:12:51,310 --> 01:12:48,949

itself a nuclear war at the height of

1793

01:12:53,410 --> 01:12:51,320

our concerns about that in the middle

1794

01:12:54,879 --> 01:12:53,420

part of this century and of course how

1795

01:12:56,709 --> 01:12:54,889

AI is going to be something that's how

1796

01:12:57,790 --> 01:12:56,719

we think about it today so I think

1797

01:13:00,009 --> 01:12:57,800

that's the phenomenons I find

1798

01:13:01,600 --> 01:13:00,019

interesting here where what seems to us

1799

01:13:03,310 --> 01:13:01,610

to be our most kind of natural intuition

1800

01:13:05,229 --> 01:13:03,320

of how to think about it is always

1801

01:13:06,819 --> 01:13:05,239

reflecting something of our time that

1802

01:13:08,529 --> 01:13:06,829

doesn't necessarily help us know how to

1803

01:13:09,910 --> 01:13:08,539

do the science better but it at least

1804

01:13:12,700 --> 01:13:09,920

tells us something about how it is that

1805

01:13:14,410 --> 01:13:12,710

we think I think that's useful I just

1806

01:13:17,439 --> 01:13:14,420

want to make one comment is there a

1807

01:13:19,450 --> 01:13:17,449

limit to AI and there are plenty of

1808

01:13:23,859 --> 01:13:19,460

books written saying there is no limit

1809

01:13:27,819 --> 01:13:23,869

and so what would that out a limit AI

1810

01:13:30,489 --> 01:13:27,829

actually look like so we can't neglect

1811

01:13:32,169 --> 01:13:30,499

that we don't know the limits of AI and

1812

01:13:37,209 --> 01:13:32,179

that certainly could surpass our

1813

01:13:39,759 --> 01:13:37,219

intelligence I'll go ahead now I have

1814

01:13:41,410 --> 01:13:39,769

only one what comes up to me is that is

1815

01:13:43,899 --> 01:13:41,420

through the history we've always had

1816

01:13:46,509 --> 01:13:43,909

apocalyptic thinking so that is part of

1817

01:13:48,250 --> 01:13:46,519

again the human DNA I think we think of

1818

01:13:49,989 --> 01:13:48,260

these end time scenarios and I think

1819

01:13:52,330 --> 01:13:49,999

it's so interesting to think of it now

1820

01:13:54,910 --> 01:13:52,340

in scientific terms I think I'm going to

1821

01:13:56,620 --> 01:13:54,920

go ahead and cut it off sorry I we've

1822

01:13:58,959 --> 01:13:56,630

been a long time on one question so if

1823

01:14:00,339 --> 01:13:58,969

you real quick point and why had two

1824

01:14:02,080 --> 01:14:00,349

points I find it interesting that we

1825

01:14:04,899 --> 01:14:02,090

think of a as other which is building on

1826

01:14:07,450 --> 01:14:04,909

theirs and then the other point I don't

1827

01:14:10,330 --> 01:14:07,460

remember at this moment is that we come

1828

01:14:13,330 --> 01:14:10,340

back aliens and a I have both been great

1829

01:14:16,810 --> 01:14:13,340

screens on which we project various

1830

01:14:19,569 --> 01:14:16,820

cycle on all species evolve and change

1831

01:14:20,739 --> 01:14:19,579

so there's an arguments about AI might

1832

01:14:23,529 --> 01:14:20,749

actually be the only thing that makes

1833

01:14:25,719 --> 01:14:23,539

humans have longevity over time yes so

1834

01:14:27,129 --> 01:14:25,729

we we will go extinct eventually and our

1835

01:14:32,160 --> 01:14:27,139

only hope of actually having a long term

1836

01:14:37,330 --> 01:14:34,810

good evening Sanjoy some blue marble

1837

01:14:40,120 --> 01:14:37,340

space so the different theologies on our

1838

01:14:41,410 --> 01:14:40,130

planet have caused large amounts of

1839

01:14:46,300 --> 01:14:41,420

conflicts right

1840

01:14:48,310 --> 01:14:46,310

how could astrobiology how could

1841

01:14:50,740 --> 01:14:48,320

astrobiology contributes to the

1842

01:14:53,950 --> 01:14:50,750

theological conversations to create

1843

01:14:57,270 --> 01:14:53,960

perhaps a spiritual pale blue dot moment

1844

01:15:02,440 --> 01:14:57,280

to kind of level the highly emotional

1845

01:15:05,470 --> 01:15:02,450

theologies Esther and I did I hear you

1846

01:15:07,470 --> 01:15:05,480

right how astrobiology could solve a

1847

01:15:12,970 --> 01:15:07,480

religious violence

1848

01:15:16,720 --> 01:15:12,980

how could astrobiology yeah yeah putting

1849

01:15:20,530 --> 01:15:16,730

it and I was this is some semesters

1850

01:15:21,820 --> 01:15:20,540

worth great question and very important

1851

01:15:24,460 --> 01:15:21,830

I think especially for their 21st

1852

01:15:27,940 --> 01:15:24,470

century what we're doing now in Assyria

1853

01:15:30,070 --> 01:15:27,950

wherever religious violence is made by

1854

01:15:32,080 --> 01:15:30,080

humans and we can change the narrative

1855

01:15:33,910 --> 01:15:32,090

we can make it aliens inside of God's

1856

01:15:35,890 --> 01:15:33,920

and we can make it you know other

1857

01:15:37,750 --> 01:15:35,900

planets I think that violence is going

1858

01:15:40,540 --> 01:15:37,760

to be sticking with us as long as we're

1859

01:15:43,210 --> 01:15:40,550

not a I and we're still human you know

1860

01:15:48,570 --> 01:15:43,220

dr. Martin Luther King jr. said that in

1861

01:15:52,390 --> 01:15:48,580

order to survive we need to find ways to

1862

01:15:55,920 --> 01:15:52,400

transcend our differences and develop a

1863

01:15:59,800 --> 01:15:55,930

world perspective and I think that

1864

01:16:02,650 --> 01:15:59,810

astrobiology actually leads us toward a

1865

01:16:04,690 --> 01:16:02,660

world perspective I think I'll make a

1866

01:16:08,290 --> 01:16:04,700

comment and in in the Bloomberg

1867

01:16:11,080 --> 01:16:08,300

dialogues on religion and astrobiology

1868

01:16:14,290 --> 01:16:11,090

we had people from representing several

1869

01:16:16,600 --> 01:16:14,300

different religions they were certainly

1870

01:16:20,920 --> 01:16:16,610

academics and all of them actually had

1871

01:16:23,050 --> 01:16:20,930

were very receptive to bringing some of

1872

01:16:25,450 --> 01:16:23,060

the concepts of astrobiology into their

1873

01:16:30,400 --> 01:16:25,460

theology so the theology is not the

1874

01:16:34,950 --> 01:16:30,410

weakness in this it is really the some

1875

01:16:40,470 --> 01:16:37,740

the dogma that's not necessarily the

1876
01:16:42,510 --> 01:16:40,480
theology I mean even a Buddhist who

1877
01:16:43,350 --> 01:16:42,520
believes in a flat earth can actually

1878
01:16:45,120 --> 01:16:43,360
understand

1879
01:16:48,480 --> 01:16:45,130
astrobiology a lot better than I thought

1880
01:16:49,740 --> 01:16:48,490
for example I'll just I'll say one thing

1881
01:16:51,780 --> 01:16:49,750
and this is not something I would have

1882
01:16:53,880 --> 01:16:51,790
said 25 years ago when I was an atheist

1883
01:16:55,500 --> 01:16:53,890
full of piss and vinegar but you get

1884
01:16:58,170 --> 01:16:55,510
older and you think about things more

1885
01:17:00,720 --> 01:16:58,180
I'm not really sure that it's right to

1886
01:17:04,530 --> 01:17:00,730
place the blame at religious feet right

1887
01:17:06,810 --> 01:17:04,540
religion is a human activity humans are

1888
01:17:10,410 --> 01:17:06,820

probably the issue I think not so much

1889

01:17:12,210 --> 01:17:10,420

religion so so humans can do religion in

1890

01:17:13,500 --> 01:17:12,220

a way that's beautiful and wonderful and

1891

01:17:15,540 --> 01:17:13,510

they can do religious in a horrible way

1892

01:17:18,270 --> 01:17:15,550

and when they do religion in a horrible

1893

01:17:20,640 --> 01:17:18,280

way it's easy to blame the religion but

1894

01:17:22,980 --> 01:17:20,650

sometimes I ask my young students when

1895

01:17:25,770 --> 01:17:22,990

they come in fuming about religion I say

1896

01:17:27,390 --> 01:17:25,780

well are you absolutely sure that if you

1897

01:17:29,250 --> 01:17:27,400

could push a button and eliminate all

1898

01:17:31,290 --> 01:17:29,260

religious belief that the world would be

1899

01:17:32,730 --> 01:17:31,300

better off because I'd be really scared

1900

01:17:34,620 --> 01:17:32,740

to do the experiment

1901

01:17:37,140 --> 01:17:34,630

you know reminds me of that South Park

1902

01:17:39,720 --> 01:17:37,150

episode where Cartman it goes to sleep

1903

01:17:42,240 --> 01:17:39,730

for he's buried under the ice for like

1904

01:17:44,160 --> 01:17:42,250

3,000 years and he wakes up way in the

1905

01:17:45,900 --> 01:17:44,170

future and there's this massive world

1906

01:17:48,420 --> 01:17:45,910

war going on between the United atheist

1907

01:17:54,600 --> 01:17:48,430

Alliance and the whatever the atheist

1908

01:17:56,640 --> 01:17:54,610

actors on that note I I would just add

1909

01:17:59,550 --> 01:17:56,650

there's this interesting question about

1910

01:18:02,780 --> 01:17:59,560

whether some extent astrobiological

1911

01:18:05,010 --> 01:18:02,790

knowledge results in ethical knowledge

1912

01:18:07,050 --> 01:18:05,020

because a lot of people make this move

1913

01:18:09,960 --> 01:18:07,060

and I think it's worth asking how we

1914

01:18:15,030 --> 01:18:09,970

wish to make that move and let's move on

1915

01:18:17,670 --> 01:18:15,040

to Michael thank you hi hi I'm Michael

1916

01:18:20,010 --> 01:18:17,680

Hecht I'm from Princeton University so I

1917

01:18:22,830 --> 01:18:20,020

am a lab scientist I do synthetic

1918

01:18:24,750 --> 01:18:22,840

biology and molecular evolution and I'm

1919

01:18:26,070 --> 01:18:24,760

going to try and I'm going to follow up

1920

01:18:27,420 --> 01:18:26,080

on the question from our colleague in

1921

01:18:29,580 --> 01:18:27,430

the back whose name I forgot who asked

1922

01:18:32,580 --> 01:18:29,590

about randomness and I want to sort of

1923

01:18:33,810 --> 01:18:32,590

reshape it a little bit so um a couple

1924

01:18:34,860 --> 01:18:33,820

years ago I was asked to give it we

1925

01:18:38,160 --> 01:18:34,870

heard about the center for theological

1926

01:18:40,320 --> 01:18:38,170

inquiry and I gave a talk there a couple

1927

01:18:42,330 --> 01:18:40,330

years ago and and you're in lucas's in

1928

01:18:43,800 --> 01:18:42,340

the audience and in talking about

1929

01:18:46,070 --> 01:18:43,810

synthetic biology and molecular

1930

01:18:48,129 --> 01:18:46,080

evolution I would use sentences like

1931

01:18:52,959 --> 01:18:48,139

evolution selects for

1932

01:18:54,040 --> 01:18:52,969

or Darwin's approaches lead towards and

1933

01:18:56,560 --> 01:18:54,050

I think it was you who asked the

1934

01:18:58,629 --> 01:18:56,570

question about that along the lines of

1935

01:18:59,770 --> 01:18:58,639

is that indicating there's agency in

1936

01:19:03,209 --> 01:18:59,780

evolution right that was your question

1937

01:19:05,260 --> 01:19:03,219

and I remember this is probably the most

1938

01:19:07,090 --> 01:19:05,270

important question I've at been asked at

1939

01:19:09,010 --> 01:19:07,100

any seminar whether you know much more

1940

01:19:11,200 --> 01:19:09,020

provocative to me than any questions I

1941

01:19:12,910 --> 01:19:11,210

was asked by I was chemist or biochemist

1942

01:19:14,500 --> 01:19:12,920

or molecular ologists right so the

1943

01:19:16,810 --> 01:19:14,510

question was you know in talking about

1944

01:19:19,419 --> 01:19:16,820

evolution selecting for leading towards

1945

01:19:21,160 --> 01:19:19,429

was I implying agency and it really sort

1946

01:19:23,470 --> 01:19:21,170

of knocked my feet out from under me and

1947

01:19:25,060 --> 01:19:23,480

so I want to talk about agency as

1948

01:19:26,830 --> 01:19:25,070

compared to randomness I think the issue

1949

01:19:28,270 --> 01:19:26,840

is not we talked earlier about

1950

01:19:30,910 --> 01:19:28,280

randomness but I don't think the issue

1951

01:19:32,770 --> 01:19:30,920

is randomness I think is there agency in

1952

01:19:34,300 --> 01:19:32,780

the universe and I know what shocked me

1953

01:19:36,939 --> 01:19:34,310

about your question at the time was that

1954

01:19:38,830 --> 01:19:36,949

even I in my discussion of evolution

1955

01:19:41,500 --> 01:19:38,840

which is inherently something that we

1956

01:19:44,890 --> 01:19:41,510

sort of learn is a process that doesn't

1957

01:19:47,830 --> 01:19:44,900

have agency right even I who work in

1958

01:19:49,810 --> 01:19:47,840

that field with in my language falling

1959

01:19:52,510 --> 01:19:49,820

back on a language that implied there is

1960

01:19:55,000 --> 01:19:52,520

agency in the world and so I wonder to

1961

01:19:58,780 --> 01:19:55,010

what extent we as humans as evolved

1962

01:20:01,359 --> 01:19:58,790

creatures right have a need in some

1963

01:20:02,950 --> 01:20:01,369

level to see agency in our universe and

1964

01:20:05,439 --> 01:20:02,960

I guess I would direct that question to

1965

01:20:08,260 --> 01:20:05,449

you how stirs it to the religious or

1966

01:20:11,740 --> 01:20:08,270

theological people um how do we look at

1967

01:20:13,990 --> 01:20:11,750

agency as agency and as seeing universe

1968

01:20:16,840 --> 01:20:14,000

that has agency where there is some

1969

01:20:19,300 --> 01:20:16,850

agency outside of us is that a human

1970

01:20:22,359 --> 01:20:19,310

need is that or is yeah I'll just leave

1971

01:20:23,919 --> 01:20:22,369

it there I feel humbled by this question

1972

01:20:25,750 --> 01:20:23,929

it's a huge question and I know that

1973

01:20:28,030 --> 01:20:25,760

there's a real theologians in the

1974

01:20:32,379 --> 01:20:28,040

audience as well in the front row I

1975

01:20:34,240 --> 01:20:32,389

would say that agency is a huge it's

1976

01:20:36,550 --> 01:20:34,250

almost like a DNA question but that

1977

01:20:38,800 --> 01:20:36,560

religions have answered it differently

1978

01:20:41,590 --> 01:20:38,810

if you think of Kelvin or predestination

1979

01:20:43,660 --> 01:20:41,600

know right God has determined everything

1980

01:20:44,979 --> 01:20:43,670

there is you don't have agency but in

1981

01:20:46,660 --> 01:20:44,989

the world I don't I don't mean human

1982

01:20:49,660 --> 01:20:46,670

agency I mean agency in the universe

1983

01:20:52,330 --> 01:20:49,670

beyond us yes so it got is as a form of

1984

01:20:54,110 --> 01:20:52,340

agency or right absolutely so in that

1985

01:20:56,750 --> 01:20:54,120

sense I would

1986

01:20:59,060 --> 01:20:56,760

I definitely say yes I think any

1987

01:21:01,910 --> 01:20:59,070

religion and I would have to quickly

1988

01:21:02,600 --> 01:21:01,920

check off my boxes of religions we'll

1989

01:21:05,480 --> 01:21:02,610

see

1990

01:21:07,520 --> 01:21:05,490

agency in the in their belief form and

1991

01:21:10,070 --> 01:21:07,530

that that is a very important connection

1992

01:21:12,290 --> 01:21:10,080

of a spiritual believer to their

1993

01:21:15,140 --> 01:21:12,300

religion right is that agency and

1994

01:21:17,990 --> 01:21:15,150

knowing that there is either there's no

1995

01:21:21,020 --> 01:21:18,000

God has determined everything or the

1996

01:21:23,000 --> 01:21:21,030

universe or that through freewill or

1997

01:21:25,370 --> 01:21:23,010

through agency through you know ginger

1998

01:21:29,120 --> 01:21:25,380

flex or whatever actions you might need

1999

01:21:30,860 --> 01:21:29,130

to do you can smoke you know good

2000

01:21:32,570 --> 01:21:30,870

outcomes is that answering your question

2001

01:21:35,330 --> 01:21:32,580

or yeah but so is the troubling thing

2002

01:21:37,070 --> 01:21:35,340

about Darwin and why he was so troubling

2003

01:21:39,290 --> 01:21:37,080

to the world in which he in which he

2004

01:21:41,810 --> 01:21:39,300

existed is the fundamental troubling

2005

01:21:44,120 --> 01:21:41,820

thing about Darwin is that he undermined

2006

01:21:46,520 --> 01:21:44,130

our need to see the world as having

2007

01:21:48,530 --> 01:21:46,530

agency that there is agency beyond us

2008

01:21:50,420 --> 01:21:48,540

whereas in Darwinian or evolutionary

2009

01:21:53,660 --> 01:21:50,430

theory maybe there isn't and that's

2010

01:21:55,520 --> 01:21:53,670

unsettling I think what Darwin was

2011

01:21:59,620 --> 01:21:55,530

getting at I think in a lot of ways and

2012

01:22:03,020 --> 01:21:59,630

what we we do as scientists is we relate

2013

01:22:07,010 --> 01:22:03,030

determinism with agency and I think I

2014

01:22:09,380 --> 01:22:07,020

think that's what we do and and you can

2015

01:22:10,640 --> 01:22:09,390

make that argument that that's what

2016

01:22:13,940 --> 01:22:10,650

we're dealing with that's certainly what

2017

01:22:17,510 --> 01:22:13,950

Darwin did one interesting response to

2018

01:22:18,140 --> 01:22:17,520

that is I think people with different

2019

01:22:21,230 --> 01:22:18,150

worldviews

2020

01:22:23,600 --> 01:22:21,240

about atheism or religion have a

2021

01:22:26,030 --> 01:22:23,610

different sense of what sort of the null

2022

01:22:28,460 --> 01:22:26,040

assumption is about that with no

2023

01:22:30,440 --> 01:22:28,470

evidence there's that book by the last

2024

01:22:33,140 --> 01:22:30,450

of the first three minutes by Steven

2025

01:22:35,030 --> 01:22:33,150

Weinberg and he ends with this sort of

2026

01:22:36,460 --> 01:22:35,040

dismal sounding statement about the

2027

01:22:39,140 --> 01:22:36,470

truth is the universe is completely

2028

01:22:41,090 --> 01:22:39,150

purposeless and you know I know what I'm

2029

01:22:44,300 --> 01:22:41,100

talking about that it's a really intense

2030

01:22:46,220 --> 01:22:44,310

statement about you know just how sorry

2031

01:22:49,610 --> 01:22:46,230

folks but it's a dismal purposeless

2032

01:22:51,530 --> 01:22:49,620

universe we live in and and so a lot of

2033

01:22:54,140 --> 01:22:51,540

a theists I know they assume that

2034

01:22:55,760 --> 01:22:54,150

without definite evidence of some

2035

01:22:58,610 --> 01:22:55,770

external agencies that the null

2036

01:23:00,590 --> 01:22:58,620

assumption is that of course there is

2037

01:23:03,380 --> 01:23:00,600

none but a lot of religious people I

2038

01:23:05,420 --> 01:23:03,390

know seem to feel the opposite that it's

2039

01:23:07,370 --> 01:23:05,430

just common sense it's obvious that

2040

01:23:09,560 --> 01:23:07,380

there is and so without so

2041

01:23:11,510 --> 01:23:09,570

the null of background basic

2042

01:23:14,060 --> 01:23:11,520

common-sense assumption without evidence

2043

01:23:16,460 --> 01:23:14,070

is that of course there's agency I just

2044

01:23:18,050 --> 01:23:16,470

want to echo what Hester said which is

2045

01:23:20,180 --> 01:23:18,060

there's there's two things going on here

2046

01:23:21,860 --> 01:23:20,190

one has to do with whether there's human

2047

01:23:24,640 --> 01:23:21,870

agency and one has to do whether there's

2048

01:23:29,360 --> 01:23:24,650

non-human agency and Darwin is

2049

01:23:31,940 --> 01:23:29,370

decreasing human agency but I'm not sure

2050

01:23:34,670 --> 01:23:31,950

jar when is decreasing divine agency in

2051
01:23:36,920 --> 01:23:34,680
a meaningful way there's two discussions

2052
01:23:40,570 --> 01:23:36,930
that get conflated there and it's really

2053
01:23:43,220 --> 01:23:40,580
worth attending to both of them Linda

2054
01:23:45,500 --> 01:23:43,230
worked with the SETI endeavor and the

2055
01:23:47,120 --> 01:23:45,510
human spaceflight endeavor and observed

2056
01:23:49,550 --> 01:23:47,130
these communities and study these

2057
01:23:52,550 --> 01:23:49,560
communities for more than 30 years now

2058
01:23:53,840 --> 01:23:52,560
and and when I talk about the human

2059
01:23:56,680 --> 01:23:53,850
spaceflight endeavor I want to focus

2060
01:23:59,420 --> 01:23:56,690
here specifically on the advocates of

2061
01:24:02,030 --> 01:23:59,430
colonizing other planets and I'm coming

2062
01:24:04,580 --> 01:24:02,040
to think of both of these movements

2063
01:24:07,370 --> 01:24:04,590

really as almost messianic religious

2064

01:24:09,350 --> 01:24:07,380

movements where where the SETI people so

2065

01:24:11,240 --> 01:24:09,360

strongly believe that we must do

2066

01:24:13,190 --> 01:24:11,250

everything we can to make contact

2067

01:24:15,380 --> 01:24:13,200

because it's possible that these

2068

01:24:17,480 --> 01:24:15,390

superior aliens will save us from

2069

01:24:19,460 --> 01:24:17,490

ourselves and with with the the

2070

01:24:21,890 --> 01:24:19,470

advocates of human colonization of other

2071

01:24:24,320 --> 01:24:21,900

planets there's a strong strain of

2072

01:24:26,330 --> 01:24:24,330

thinking that if humans can get off this

2073

01:24:28,670 --> 01:24:26,340

planet that we humans have ruined it

2074

01:24:30,380 --> 01:24:28,680

will all be different and human culture

2075

01:24:31,790 --> 01:24:30,390

will be different and it will be better

2076

01:24:34,070 --> 01:24:31,800

and I'm wondering if any of you will

2077

01:24:36,980 --> 01:24:34,080

that I'm afraid we are running out of

2078

01:24:41,270 --> 01:24:36,990

time that I think was a great statement

2079

01:24:43,700 --> 01:24:41,280

of how we roll all of these questions of

2080

01:24:45,200 --> 01:24:43,710

ethics and values and risk into our

2081

01:24:47,630 --> 01:24:45,210

questions of science and how deeply

2082

01:24:50,120 --> 01:24:47,640

related they are

2083

01:24:51,650 --> 01:24:50,130

I know these folks if you get them

2084

01:24:55,010 --> 01:24:51,660

talking it would be very hard to get

2085

01:24:56,750 --> 01:24:55,020

them to stop which is a wonderful thing

2086

01:25:00,650 --> 01:24:56,760

so hopefully you will see them later

2087

01:25:02,510 --> 01:25:00,660

today and can ask them questions with an

2088

01:25:04,910 --> 01:25:02,520

eye on that clock right down there at

2089

01:25:07,760 --> 01:25:04,920

your feet if you have one sentence you

2090

01:25:09,290 --> 01:25:07,770

would like to end with Kelly thinks fast

2091

01:25:11,690 --> 01:25:09,300

on his feet let's start with Kelly I

2092

01:25:13,280 --> 01:25:11,700

would say clearly this is a great

2093

01:25:15,920 --> 01:25:13,290

audience it's a really great question so

2094

01:25:18,290 --> 01:25:15,930

you all need to go to the social meeting

2095

01:25:20,210 --> 01:25:18,300

in Reno in March and we

2096

01:25:21,470 --> 01:25:20,220

you can hash this out over beer to your

2097

01:25:26,240 --> 01:25:21,480

heart's content

2098

01:25:29,780 --> 01:25:26,250

that would be great in uh answers your

2099

01:25:31,790 --> 01:25:29,790

question are in reference to it I always

2100

01:25:35,990 --> 01:25:31,800

thought it was interesting and how these

2101
01:25:38,090 --> 01:25:36,000
sort of uber atheist nerds I grew up

2102
01:25:40,820 --> 01:25:38,100
reading like arthur c clarke and carl

2103
01:25:43,460 --> 01:25:40,830
sagan who you know we're pretty

2104
01:25:45,260 --> 01:25:43,470
atheistic gildo they might not have used

2105
01:25:48,080 --> 01:25:45,270
that word to describe themselves they

2106
01:25:50,150 --> 01:25:48,090
did believe very much in the possibility

2107
01:25:52,070 --> 01:25:50,160
of sort of transcendent contact with

2108
01:25:54,860 --> 01:25:52,080
aliens and it's excellent next that

2109
01:25:59,210 --> 01:25:54,870
breaks me as an acceptable religious

2110
01:26:01,610 --> 01:25:59,220
belief for nerds for me it's fascinating

2111
01:26:04,340 --> 01:26:01,620
to hear if you're in a theater religious

2112
01:26:06,680 --> 01:26:04,350
the need to believe right intuitively to

2113
01:26:10,820 --> 01:26:06,690

believe in a future life and that's the

2114

01:26:14,300 --> 01:26:10,830

power of belief there is some common

2115

01:26:16,340 --> 01:26:14,310

ground I think between those who believe

2116

01:26:19,370 --> 01:26:16,350

in religion and those who don't I like

2117

01:26:23,000 --> 01:26:19,380

to quote from the Nobel laureate jacques

2118

01:26:25,520 --> 01:26:23,010

monod molecular biologist who was a

2119

01:26:28,040 --> 01:26:25,530

known atheist and he remarked that the

2120

01:26:29,810 --> 01:26:28,050

most important results of science have

2121

01:26:32,380 --> 01:26:29,820

been to change the relationship of man

2122

01:26:37,870 --> 01:26:32,390

to the universe in a way he sees himself

2123

01:26:39,830 --> 01:26:37,880

in the universe I guess mine is a

2124

01:26:41,090 --> 01:26:39,840

collective knowledge is always more

2125

01:26:43,460 --> 01:26:41,100

powerful than what we know as

2126

01:26:45,170 --> 01:26:43,470

individuals and that's obviously true

2127

01:26:48,020 --> 01:26:45,180

from the history of life and the whole

2128

01:26:49,880 --> 01:26:48,030

point of life being a hierarchy so we

2129

01:26:52,760 --> 01:26:49,890

really need to rely on each other to get

2130

01:26:55,640 --> 01:26:52,770

outside of our you know indoctrinations

2131

01:26:56,900 --> 01:26:55,650

and our experiential spheres of the way

2132

01:26:59,270 --> 01:26:56,910

we think about things whether it's our

2133

01:27:00,650 --> 01:26:59,280

discipline or our religion and think

2134

01:27:02,060 --> 01:27:00,660

about things from other people's

2135

01:27:05,600 --> 01:27:02,070

perspective to get to the answers of

2136

01:27:06,770 --> 01:27:05,610

these questions I think my final thought

2137

01:27:09,920 --> 01:27:06,780

would be what is it about our language

2138

01:27:12,560 --> 01:27:09,930

our culture our politics our society

2139

01:27:14,930 --> 01:27:12,570

that can help us understand why we think

2140

01:27:16,160 --> 01:27:14,940

the way we do and what seems so obvious

2141

01:27:18,130 --> 01:27:16,170

to us as the right way to think about it

2142

01:27:20,390 --> 01:27:18,140

is reflecting our time in our place here

2143

01:27:22,100 --> 01:27:20,400

thank you to the panel and thank you to