



Ask An Astrobiologist



EPISODE 26: NOVEMBER 12<sup>TH</sup>, 2019

**DR. AARON GRONSTAL**



**Astrobiology Program**

1  
00:00:35,010 --> 00:00:32,000

[Music]

2  
00:00:38,100 --> 00:00:35,020

greetings friends of astrobiology and

3  
00:00:40,350 --> 00:00:38,110

welcome to ask an astrobiologist the

4  
00:00:42,770 --> 00:00:40,360

show that likes to focus on the science

5  
00:00:45,180 --> 00:00:42,780

and the scientists behind our quest to

6  
00:00:47,610 --> 00:00:45,190

understand the nature of life in the

7  
00:00:50,130 --> 00:00:47,620

cosmos and today we have a really

8  
00:00:52,470 --> 00:00:50,140

awesome guest our guest is the

9  
00:00:54,720 --> 00:00:52,480

illustrator and scientist who creates

10  
00:00:57,180 --> 00:00:54,730

the NASA Astrobiology graphic history

11  
00:00:59,640 --> 00:00:57,190

series he also was the one who created

12  
00:01:01,860 --> 00:00:59,650

all those awesome graphics you just saw

13  
00:01:04,410 --> 00:01:01,870

in the opening credits for our show ask

14

00:01:06,090 --> 00:01:04,420

an astrobiologist before I introduce him

15

00:01:08,550 --> 00:01:06,100

though and we start having a chat about

16

00:01:10,080 --> 00:01:08,560

his work in his career and give you a

17

00:01:12,210 --> 00:01:10,090

chance to ask some questions of your own

18

00:01:15,120 --> 00:01:12,220

we have a few you know things to do

19

00:01:17,010 --> 00:01:15,130

first like our background quiz as our

20

00:01:18,990 --> 00:01:17,020

longtime audience knows we have a

21

00:01:21,780 --> 00:01:19,000

background quiz every single month for

22

00:01:23,130 --> 00:01:21,790

the picture behind the host to give you

23

00:01:25,140 --> 00:01:23,140

a chance to guess what that picture

24

00:01:27,600 --> 00:01:25,150

shows maybe why it's relevant to

25

00:01:30,630 --> 00:01:27,610

astrobiology and a chance to win a cool

26

00:01:32,820 --> 00:01:30,640

little prize so this month this past

27

00:01:35,250 --> 00:01:32,830

month contest we have a picture which

28

00:01:37,890 --> 00:01:35,260

mike is putting up right now shows a

29

00:01:41,300 --> 00:01:37,900

really beautiful karst cave system in

30

00:01:43,350 --> 00:01:41,310

Italy known as the frasassi caves

31

00:01:46,500 --> 00:01:43,360

astrobiologists have been going here to

32

00:01:48,750 --> 00:01:46,510

study life deep underground metabolizing

33

00:01:51,120 --> 00:01:48,760

materials from the rock itself living

34

00:01:53,730 --> 00:01:51,130

off of sulphur and the material deep in

35

00:01:56,640 --> 00:01:53,740

this cave now this month's winner was

36

00:01:59,070 --> 00:01:56,650

hashish Natha a longtime friend of the

37

00:02:01,410 --> 00:01:59,080

show and so for next month you can try

38

00:02:04,590 --> 00:02:01,420

to guess what's behind me right now in

39  
00:02:07,200 --> 00:02:04,600  
this background so moving on many of you

40  
00:02:09,270 --> 00:02:07,210  
also know that we have an ambassador of

41  
00:02:11,850 --> 00:02:09,280  
the month that we name every month as

42  
00:02:14,070 --> 00:02:11,860  
well this is someone who shares as much

43  
00:02:16,320 --> 00:02:14,080  
as they can about our upcoming guests

44  
00:02:19,080 --> 00:02:16,330  
about the show who tries to get the rest

45  
00:02:20,820 --> 00:02:19,090  
of our audience intrigued and sharing in

46  
00:02:21,780 --> 00:02:20,830  
this journey this conversation about

47  
00:02:24,270 --> 00:02:21,790  
astrobiology

48  
00:02:27,869 --> 00:02:24,280  
and this month's ambassador of the month

49  
00:02:29,580 --> 00:02:27,879  
is taejun so at TL acharya on twitter

50  
00:02:32,430 --> 00:02:29,590  
thank you very much for being an awesome

51  
00:02:34,289 --> 00:02:32,440  
ambassador for our show we really

52  
00:02:36,059 --> 00:02:34,299  
appreciate your enthusiasm for asking

53  
00:02:37,559 --> 00:02:36,069  
astrobiologists and all you've done to

54  
00:02:39,600 --> 00:02:37,569  
share the show we hope the rest of you

55  
00:02:41,850 --> 00:02:39,610  
will join it angel as

56  
00:02:43,680 --> 00:02:41,860  
our other friends and share what you can

57  
00:02:45,680 --> 00:02:43,690  
about our upcoming guests our past

58  
00:02:48,360 --> 00:02:45,690  
guests they're awesome work and research

59  
00:02:50,370 --> 00:02:48,370  
we really appreciate all that you can do

60  
00:02:52,410 --> 00:02:50,380  
there so let's get this show moving

61  
00:02:53,610 --> 00:02:52,420  
forward for ask an astrobiologist for

62  
00:02:55,950 --> 00:02:53,620  
November 20 19

63  
00:02:58,530 --> 00:02:55,960

our guest this month is dr. Aaron

64

00:03:00,990 --> 00:02:58,540

Gronstal he's the creator of the NASA

65

00:03:03,360 --> 00:03:01,000

Astrobiology graphic history series

66

00:03:05,460 --> 00:03:03,370

those beautiful little graphic history

67

00:03:07,170 --> 00:03:05,470

books that we give out as prizes that

68

00:03:08,880 --> 00:03:07,180

you've probably seen at various

69

00:03:11,370 --> 00:03:08,890

conferences and events for NASA

70

00:03:12,840 --> 00:03:11,380

Astrobiology it's such a thrill to have

71

00:03:14,940 --> 00:03:12,850

him here on the show to talk about art

72

00:03:16,740 --> 00:03:14,950

and science so dr. Gronstal thank you

73

00:03:19,490 --> 00:03:16,750

very much for joining us here on ask an

74

00:03:22,920 --> 00:03:19,500

astrobiologist thank you for having me

75

00:03:25,740 --> 00:03:22,930

yeah thank you this is great having you

76

00:03:28,290 --> 00:03:25,750

here we often with our show we'll start

77

00:03:30,900 --> 00:03:28,300

off talking a bit just you and I about

78

00:03:32,670 --> 00:03:30,910

your life your career your what you're

79

00:03:35,180 --> 00:03:32,680

currently doing and then we'll open it

80

00:03:38,340 --> 00:03:35,190

up to our audience to ask questions

81

00:03:40,199 --> 00:03:38,350

watching right now you can use hashtag

82

00:03:42,150 --> 00:03:40,209

asked Astro bio on Twitter to ask

83

00:03:44,670 --> 00:03:42,160

questions you can also ask questions

84

00:03:48,030 --> 00:03:44,680

right now on the chat and the chat boxes

85

00:03:48,560 --> 00:03:48,040

in second net NASA Astrobiology Facebook

86

00:03:51,780 --> 00:03:48,570

page

87

00:03:53,759 --> 00:03:51,790

so dr. Gronstal we're gonna talk a lot

88

00:03:56,790 --> 00:03:53,769

obviously about artwork since you do a

89

00:03:58,380 --> 00:03:56,800

lot of that now our audience won't know

90

00:04:01,110 --> 00:03:58,390

though that you also have a background

91

00:04:03,780 --> 00:04:01,120

in science so would you mind just taking

92

00:04:06,150 --> 00:04:03,790

us on a little journey through your

93

00:04:09,660 --> 00:04:06,160

childhood experiences the things I did

94

00:04:12,810 --> 00:04:09,670

in art and in science Wow I mean it's

95

00:04:14,430 --> 00:04:12,820

only from childhood let's see I guess I

96

00:04:17,099 --> 00:04:14,440

starting with the artwork and stuff my

97

00:04:19,860 --> 00:04:17,109

mother's a visual artist so growing up I

98

00:04:21,810 --> 00:04:19,870

always had lots and lots of different

99

00:04:24,090 --> 00:04:21,820

materials around to work with and things

100

00:04:27,870 --> 00:04:24,100

and she was she'd worked in a lot of ink

101  
00:04:30,030 --> 00:04:27,880  
work and watercolors so I always knew

102  
00:04:31,140 --> 00:04:30,040  
that I couldn't do watercolor as well as

103  
00:04:32,640 --> 00:04:31,150  
she did so I went more toward

104  
00:04:35,250 --> 00:04:32,650  
illustration and then oil painting and

105  
00:04:37,500 --> 00:04:35,260  
that sort of stuff so that kind of

106  
00:04:39,000 --> 00:04:37,510  
sparks the art early on and then I

107  
00:04:42,890 --> 00:04:39,010  
always kind of generally had an interest

108  
00:04:44,940 --> 00:04:42,900  
in science let's say it was probably

109  
00:04:46,940 --> 00:04:44,950  
probably my biology teacher in high

110  
00:04:48,320 --> 00:04:46,950  
school that really inspired that

111  
00:04:50,390 --> 00:04:48,330  
interest in

112  
00:04:53,140 --> 00:04:50,400  
and kind of maybe actually considered as

113  
00:04:56,869 --> 00:04:53,150

a career and and I went forward and

114

00:04:58,520 --> 00:04:56,879

applied the universities I ended up at

115

00:05:01,550 --> 00:04:58,530

Berkeley doing molecular environmental

116

00:05:03,309 --> 00:05:01,560

biology and I also did a Bachelor of

117

00:05:05,899 --> 00:05:03,319

Arts in theater and performance studies

118

00:05:08,600 --> 00:05:05,909

also had a great theatre instructor in

119

00:05:10,369 --> 00:05:08,610

high school to you so I always had to my

120

00:05:11,540 --> 00:05:10,379

philosophy was always kind of if it

121

00:05:13,040 --> 00:05:11,550

sounds interesting I'm gonna learn

122

00:05:15,770 --> 00:05:13,050

something I might as well just do it so

123

00:05:17,300 --> 00:05:15,780

I was paying group and iOS always paying

124

00:05:20,439 --> 00:05:17,310

out-of-state tuition in California so I

125

00:05:24,110 --> 00:05:20,449

I did two degrees got my money's worth

126

00:05:26,240 --> 00:05:24,120

nice that's a man yeah I guess from

127

00:05:28,730 --> 00:05:26,250

there while I was at Berkeley there was

128

00:05:30,800 --> 00:05:28,740

a kind of a think tank I got involved

129

00:05:34,159 --> 00:05:30,810

with it was a program at NASA and called

130

00:05:36,890 --> 00:05:34,169

to Mars by 2020 and I was with a group

131

00:05:39,740 --> 00:05:36,900

of students working on redesigning

132

00:05:43,279 --> 00:05:39,750

cooling systems for Mars spacesuits that

133

00:05:46,129 --> 00:05:43,289

would work in in Mars gravity and in

134

00:05:48,110 --> 00:05:46,139

that spent some time at Ames and got

135

00:05:51,320 --> 00:05:48,120

introduced to the astrobiology kind of

136

00:05:57,529 --> 00:05:51,330

science group at Ames their bike okay

137

00:06:00,709 --> 00:05:57,539

and yeah then let's see it was kind of

138

00:06:02,089 --> 00:06:00,719

partly through undergrad I ended up

139

00:06:05,329 --> 00:06:02,099

being around in Berkeley in the summer

140

00:06:07,309 --> 00:06:05,339

and just out of the blue send an email

141

00:06:09,079 --> 00:06:07,319

to the contact at the bottom of the

142

00:06:11,240 --> 00:06:09,089

astrobiology integration office page at

143

00:06:13,610 --> 00:06:11,250

Ames at the time and ended up meeting

144

00:06:15,200 --> 00:06:13,620

with Kathryn Canal who was at the NASA

145

00:06:18,040 --> 00:06:15,210

Institute for advanced concepts there

146

00:06:20,420 --> 00:06:18,050

and yeah before I knew it that was

147

00:06:22,040 --> 00:06:20,430

spending my summer working in the office

148

00:06:24,439 --> 00:06:22,050

there and doing a lot of science writing

149

00:06:26,360 --> 00:06:24,449

and they appreciated that I was doing

150

00:06:27,980 --> 00:06:26,370

molecular environmental biology but also

151  
00:06:30,379 --> 00:06:27,990  
a degree in theater and my focus was

152  
00:06:32,779 --> 00:06:30,389  
kind of playwriting so it was they

153  
00:06:34,490 --> 00:06:32,789  
needed someone that could do time

154  
00:06:36,649 --> 00:06:34,500  
communication really and that's that's

155  
00:06:40,309 --> 00:06:36,659  
that was kind of my first foray immune

156  
00:06:43,730 --> 00:06:40,319  
occasion and from there became a home

157  
00:06:45,589 --> 00:06:43,740  
visiting researcher at Nyack's and yeah

158  
00:06:47,529 --> 00:06:45,599  
just kind of stuck with it as I

159  
00:06:50,600 --> 00:06:47,539  
continued on through further education

160  
00:06:52,579 --> 00:06:50,610  
that's very cool so you feel that having

161  
00:06:54,140 --> 00:06:52,589  
studied theater in school as well kind

162  
00:06:55,730 --> 00:06:54,150  
of you feel like that that helped you

163  
00:06:57,309 --> 00:06:55,740

then prepare for being a better science

164

00:07:00,060 --> 00:06:57,319

communicator having some more background

165

00:07:03,630 --> 00:07:00,070

beyond just the science itself

166

00:07:07,170 --> 00:07:03,640

absolutely I mean it also also the p.m.

167

00:07:08,430 --> 00:07:07,180

like I ended up klutzy I did spend some

168

00:07:11,910 --> 00:07:08,440

time at the University of Melbourne

169

00:07:13,680 --> 00:07:11,920

understanding the playwright brilliant

170

00:07:17,010 --> 00:07:13,690

brilliant woman called the Cathy Mary

171

00:07:18,690 --> 00:07:17,020

Fallon and kept up with my studies there

172

00:07:22,020 --> 00:07:18,700

and science as well and I ended up

173

00:07:24,780 --> 00:07:22,030

taking I had a that did some work as an

174

00:07:25,950 --> 00:07:24,790

actor I had a play that was accepted

175

00:07:29,540 --> 00:07:25,960

into the International writers festival

176

00:07:32,880 --> 00:07:29,550

the season at La MaMa theater and it was

177

00:07:35,520 --> 00:07:32,890

basically my Anatomy notes turned into a

178

00:07:37,020 --> 00:07:35,530

stage play because I was trying to write

179

00:07:37,880 --> 00:07:37,030

a play but also had a study for my

180

00:07:41,700 --> 00:07:37,890

finals

181

00:07:43,200 --> 00:07:41,710

so yeah that's weaving together the

182

00:07:45,330 --> 00:07:43,210

science in the art at that point I think

183

00:07:47,880 --> 00:07:45,340

and and it went over really well it was

184

00:07:49,500 --> 00:07:47,890

a lot of fun yeah so cool heroes this

185

00:07:50,790 --> 00:07:49,510

things kind of have intertwined

186

00:07:52,620 --> 00:07:50,800

throughout your life I mean I remember

187

00:07:54,840 --> 00:07:52,630

myself my father's an artist and

188

00:07:56,640 --> 00:07:54,850

I recall as a young child smelling like

189

00:07:58,920 --> 00:07:56,650

linseed oil and Japan and dryer and

190

00:08:01,140 --> 00:07:58,930

things coming from his studio and and

191

00:08:02,790 --> 00:08:01,150

wondering for me as a scientist like

192

00:08:04,650 --> 00:08:02,800

what were those thing is chemically why

193

00:08:05,730 --> 00:08:04,660

why do they smell that way and and so

194

00:08:07,830 --> 00:08:05,740

it's kind of cool to have that inner

195

00:08:10,080 --> 00:08:07,840

pinning of art and science coming

196

00:08:12,840 --> 00:08:10,090

together in your young life and then

197

00:08:14,160 --> 00:08:12,850

moving forward so let's let's talk a bit

198

00:08:16,230 --> 00:08:14,170

about your art career then what really

199

00:08:18,150 --> 00:08:16,240

got you to this point now of now being

200

00:08:21,230 --> 00:08:18,160

an illustrator creating these these

201  
00:08:24,000 --> 00:08:21,240  
awesome graphic histories for NASA um

202  
00:08:26,340 --> 00:08:24,010  
whoa let's yeah I went on to do a

203  
00:08:29,490 --> 00:08:26,350  
master's in space science at the inner

204  
00:08:31,290 --> 00:08:29,500  
state university and then PhD in England

205  
00:08:33,120 --> 00:08:31,300  
at the planetarium Space Science

206  
00:08:35,240 --> 00:08:33,130  
Research Institute with Charles cacao

207  
00:08:39,450 --> 00:08:35,250  
who was also on ask and astrobiologist

208  
00:08:41,190 --> 00:08:39,460  
was actually his first PhD student but

209  
00:08:42,390 --> 00:08:41,200  
all that time I continued kind of

210  
00:08:44,820 --> 00:08:42,400  
working remotely with with the

211  
00:08:46,500 --> 00:08:44,830  
astrobiology what started as the

212  
00:08:49,110 --> 00:08:46,510  
astrobiology integration office and then

213  
00:08:50,580 --> 00:08:49,120

then the nei came about and then when I

214

00:08:56,430 --> 00:08:50,590

became the astrobiology program office

215

00:08:58,980 --> 00:08:56,440

at headquarters but yeah my initial path

216

00:09:01,230 --> 00:08:58,990

was angling the research I was made

217

00:09:04,080 --> 00:09:01,240

possibly I couldn't academia and that

218

00:09:05,730 --> 00:09:04,090

sort of thing and then um always just

219

00:09:10,380 --> 00:09:05,740

continued with my artwork and like my

220

00:09:10,879 --> 00:09:10,390

spare time and did a little bit of kind

221

00:09:14,179 --> 00:09:10,889

of it was

222

00:09:16,220 --> 00:09:14,189

creation stuff for the astrology

223

00:09:19,419 --> 00:09:16,230

magazine and for other things we're

224

00:09:25,099 --> 00:09:19,429

coming out of yesterday I and things and

225

00:09:27,220 --> 00:09:25,109

then once he finished my PhD and let's

226

00:09:29,319 --> 00:09:27,230

see I think I did my PhD in England and

227

00:09:32,269 --> 00:09:29,329

during the course of that fell in love

228

00:09:37,489 --> 00:09:32,279

and finished my PhD and kind of ended up

229

00:09:39,530 --> 00:09:37,499

in a position where that was the Defense

230

00:09:41,179 --> 00:09:39,540

of Marriage Act at that at that time so

231

00:09:43,970 --> 00:09:41,189

same-sex couples had another immigration

232

00:09:48,109 --> 00:09:43,980

rights so I was put in the position of

233

00:09:49,340 --> 00:09:48,119

choosing career or love and and what

234

00:09:54,919 --> 00:09:49,350

with love and decided to stay in England

235

00:09:57,619 --> 00:09:54,929

for a while and luckily you know I had

236

00:09:59,869 --> 00:09:57,629

other kind of skills to fall back on and

237

00:10:01,220 --> 00:09:59,879

and there were at that time there was

238

00:10:02,359 --> 00:10:01,230

there was a big need for some signs of

239

00:10:05,179 --> 00:10:02,369

science communication stuff at the

240

00:10:06,679 --> 00:10:05,189

astrobiology program and wonderful

241

00:10:08,840 --> 00:10:06,689

colleagues and NASA has been very

242

00:10:10,119 --> 00:10:08,850

supportive and all that and kind of

243

00:10:12,139 --> 00:10:10,129

found other routes in and then it was up

244

00:10:14,659 --> 00:10:12,149

steering a little bit away from research

245

00:10:16,189 --> 00:10:14,669

and more toward like the communication

246

00:10:19,039 --> 00:10:16,199

side and the administration side and

247

00:10:22,429 --> 00:10:19,049

that sort of thing and then things that

248

00:10:24,859 --> 00:10:22,439

I carry remotely and travel for so and

249

00:10:27,710 --> 00:10:24,869

so also I am curious for myself for

250

00:10:29,809 --> 00:10:27,720

others who started off in pathways with

251  
00:10:31,340 --> 00:10:29,819  
science who really thought that we would

252  
00:10:33,409 --> 00:10:31,350  
continue and become you know research

253  
00:10:36,079 --> 00:10:33,419  
professors continued you know through

254  
00:10:37,189 --> 00:10:36,089  
postdocs and the kinds of things you

255  
00:10:39,409 --> 00:10:37,199  
know for those of us who haven't gone

256  
00:10:40,850 --> 00:10:39,419  
that way what was the big thing for you

257  
00:10:42,350 --> 00:10:40,860  
I mean obviously you had love and that's

258  
00:10:44,150 --> 00:10:42,360  
that's wonderful

259  
00:10:45,590 --> 00:10:44,160  
but what was what was the big thing for

260  
00:10:48,350 --> 00:10:45,600  
you that really have helped you to

261  
00:10:50,239 --> 00:10:48,360  
maintain your focus moving forward after

262  
00:10:52,159 --> 00:10:50,249  
leaving that kind of on the side and

263  
00:10:53,569 --> 00:10:52,169

really then focusing on becoming a

264

00:10:55,779 --> 00:10:53,579

communicator of science and someone who

265

00:10:59,239 --> 00:10:55,789

really shares science through artwork I

266

00:11:02,629 --> 00:10:59,249

mean less than a passion for this for

267

00:11:06,169 --> 00:11:02,639

the science and and I think also for me

268

00:11:10,400 --> 00:11:06,179

I was passionate about a lot of areas of

269

00:11:12,259 --> 00:11:10,410

science within astrobiology and I never

270

00:11:14,479 --> 00:11:12,269

really hit that one question that I

271

00:11:17,150 --> 00:11:14,489

really wanted to pursue and build a

272

00:11:19,340 --> 00:11:17,160

career around and I was I was too

273

00:11:21,640 --> 00:11:19,350

interested in the broad a broad question

274

00:11:23,530 --> 00:11:21,650

and

275

00:11:24,970 --> 00:11:23,540

which is why my interest in like working

276

00:11:27,700 --> 00:11:24,980

with the with the program came about

277

00:11:28,930 --> 00:11:27,710

because that's you know you've got your

278

00:11:30,940 --> 00:11:28,940

hands and a lot of different places and

279

00:11:32,680 --> 00:11:30,950

you're you're you're helping like the

280

00:11:33,760 --> 00:11:32,690

science community along and and in

281

00:11:36,580 --> 00:11:33,770

pursuing these big questions of

282

00:11:39,370 --> 00:11:36,590

astrobiology and I think like that that

283

00:11:41,200 --> 00:11:39,380

was a that was a big driver also just

284

00:11:43,390 --> 00:11:41,210

the incredible people at the program and

285

00:11:45,970 --> 00:11:43,400

colleagues that I work with and the

286

00:11:46,930 --> 00:11:45,980

environment there that you know it

287

00:11:48,370 --> 00:11:46,940

would've been hard to leave and go into

288

00:11:50,020 --> 00:11:48,380

academia and that kind of stuff because

289

00:11:51,880 --> 00:11:50,030

the wonderful people that I get to work

290

00:11:55,260 --> 00:11:51,890

with and in the community that's built

291

00:11:59,980 --> 00:11:55,270

around astrobiology there as well and

292

00:12:01,210 --> 00:11:59,990

that was actually and I've always had a

293

00:12:02,590 --> 00:12:01,220

passion for art always kept up with

294

00:12:04,420 --> 00:12:02,600

artwork and that sort of thing and it

295

00:12:06,990 --> 00:12:04,430

was his LarryBoy tech after she became

296

00:12:10,500 --> 00:12:07,000

kind of the program scientist at NASA

297

00:12:12,640 --> 00:12:10,510

was at my apartment it's all of my

298

00:12:14,410 --> 00:12:12,650

paintings and drawings and everything on

299

00:12:19,090 --> 00:12:14,420

the wall and she and Linda buildings

300

00:12:22,750 --> 00:12:19,100

have been discussing doing some sort of

301  
00:12:24,820 --> 00:12:22,760  
art based outreach project some sort of

302  
00:12:26,110 --> 00:12:24,830  
book or you know whether it was comic or

303  
00:12:28,000 --> 00:12:26,120  
if it was a children's book and that

304  
00:12:29,620 --> 00:12:28,010  
sort of thing and and she kind of made

305  
00:12:31,090 --> 00:12:29,630  
that connection was like oh well like

306  
00:12:34,810 --> 00:12:31,100  
we'd have this in-house let's let's make

307  
00:12:37,420 --> 00:12:34,820  
use of it so yeah well let's just talk a

308  
00:12:41,050 --> 00:12:37,430  
bit about the the creation then of the

309  
00:12:43,720 --> 00:12:41,060  
astrobiology graphic history series what

310  
00:12:45,910 --> 00:12:43,730  
is your process how do you how do you

311  
00:12:48,760 --> 00:12:45,920  
start from just you know the idea for an

312  
00:12:51,460 --> 00:12:48,770  
issue and then bring that to this

313  
00:12:54,460 --> 00:12:51,470

beautiful digital or print format that

314

00:12:57,670 --> 00:12:54,470

people then can use I think it was

315

00:12:59,170 --> 00:12:57,680

like so the first issue was made in

316

00:13:01,540 --> 00:12:59,180

conjunction with the 50th anniversary of

317

00:13:03,160 --> 00:13:01,550

exobiology at NASA as part of the 50th

318

00:13:05,050 --> 00:13:03,170

anniversary celebrations they wanted

319

00:13:07,960 --> 00:13:05,060

like the first kind of books to be out

320

00:13:10,510 --> 00:13:07,970

and so that that was you know just a his

321

00:13:12,640 --> 00:13:10,520

history of the start of exobiology and

322

00:13:16,020 --> 00:13:12,650

astrobiology at NASA and so it was kind

323

00:13:18,490 --> 00:13:16,030

of a built in topic for that one and

324

00:13:20,050 --> 00:13:18,500

yeah that doesn't up being going over

325

00:13:21,670 --> 00:13:20,060

really well and being successful and

326  
00:13:26,110 --> 00:13:21,680  
people really enjoyed it so we decided

327  
00:13:28,150 --> 00:13:26,120  
to continue on and then we kind of

328  
00:13:31,570 --> 00:13:28,160  
decided to start with mission oriented

329  
00:13:33,940 --> 00:13:31,580  
issues and focused on Mars because at

330  
00:13:35,170 --> 00:13:33,950  
the time you know curiosity was being

331  
00:13:37,540 --> 00:13:35,180  
prepared and there was a lot about

332  
00:13:39,160 --> 00:13:37,550  
and stuff so that was that was a there

333  
00:13:42,610 --> 00:13:39,170  
are like lots of nice outreach events

334  
00:13:46,090 --> 00:13:42,620  
around that launch that we could focus

335  
00:13:48,640 --> 00:13:46,100  
on so we started with Mars missions and

336  
00:13:52,090 --> 00:13:48,650  
then and I went in our solar system and

337  
00:13:54,850 --> 00:13:52,100  
outer solar system and since then it's

338  
00:13:57,190 --> 00:13:54,860

been kind of God guided by pertinent

339

00:13:59,080 --> 00:13:57,200

topics in astrobiology at the time so

340

00:14:03,310 --> 00:13:59,090

what's you know what developments have

341

00:14:04,510 --> 00:14:03,320

been happening and and things that we we

342

00:14:07,210 --> 00:14:04,520

see where there's a gap in communication

343

00:14:09,370 --> 00:14:07,220

that needs to be filled a bit and all

344

00:14:11,050 --> 00:14:09,380

that's built around get other the

345

00:14:13,240 --> 00:14:11,060

strategy and the ten-year plan from the

346

00:14:14,650 --> 00:14:13,250

Academy of Sciences and what we have

347

00:14:18,070 --> 00:14:14,660

coming up in terms of missions and that

348

00:14:19,660 --> 00:14:18,080

sort of thing so awesome yeah I know I

349

00:14:22,000 --> 00:14:19,670

absolutely love that you have so many

350

00:14:23,740 --> 00:14:22,010

different research field sites on earth

351  
00:14:25,240 --> 00:14:23,750  
in the in the astrobiology graphic

352  
00:14:27,700 --> 00:14:25,250  
histories you also have so many

353  
00:14:29,710 --> 00:14:27,710  
scientists there for myself I mean I

354  
00:14:31,090 --> 00:14:29,720  
absolutely love that I saw my own fueled

355  
00:14:33,490 --> 00:14:31,100  
what fueled site for my graduate

356  
00:14:39,730 --> 00:14:33,500  
research in the graphic history at Bohr

357  
00:14:41,380 --> 00:14:39,740  
is what was what was it like trying to

358  
00:14:43,720 --> 00:14:41,390  
get all these different scientists to

359  
00:14:47,470 --> 00:14:43,730  
get them into the graphic history series

360  
00:14:48,970 --> 00:14:47,480  
to to create them as artwork and then

361  
00:14:51,940 --> 00:14:48,980  
she'll try to give them a voice through

362  
00:14:53,920 --> 00:14:51,950  
this medium it can be challenging but it

363  
00:14:55,600 --> 00:14:53,930

I mean it's a lot of fun there's so

364

00:14:57,010 --> 00:14:55,610

meanness in the community so big and

365

00:14:58,660 --> 00:14:57,020

there's so many wonderful reach

366

00:15:01,720 --> 00:14:58,670

researchers doing amazing work that it's

367

00:15:03,910 --> 00:15:01,730

really hard to kind of pick you know who

368

00:15:06,460 --> 00:15:03,920

we feature and that kind of stuff and a

369

00:15:07,690 --> 00:15:06,470

lot of that you know i when i'm

370

00:15:09,340 --> 00:15:07,700

attending conferences and things I'll

371

00:15:10,990 --> 00:15:09,350

sit and I listen the kind of lectures on

372

00:15:12,700 --> 00:15:11,000

the topic that I'm focusing on and kind

373

00:15:15,040 --> 00:15:12,710

of doing the background research for and

374

00:15:17,770 --> 00:15:15,050

you know I try to include as many people

375

00:15:19,630 --> 00:15:17,780

as possible but it's a big headache for

376

00:15:20,470 --> 00:15:19,640

Linda Billings because she's the one

377

00:15:23,530 --> 00:15:20,480

that has to go around and get the

378

00:15:25,270 --> 00:15:23,540

permissions for everybody the last one

379

00:15:26,980 --> 00:15:25,280

had I don't know how many 40 people in

380

00:15:30,760 --> 00:15:26,990

it so she said she said I needed to slim

381

00:15:32,770 --> 00:15:30,770

that down for the next couple but um ya

382

00:15:34,330 --> 00:15:32,780

know it's it's you know I try to include

383

00:15:36,160 --> 00:15:34,340

as many people as possible and as

384

00:15:38,530 --> 00:15:36,170

diverse a group as people as possible

385

00:15:39,880 --> 00:15:38,540

like I think it's important to show the

386

00:15:42,160 --> 00:15:39,890

diversity and the community and stuff as

387

00:15:44,290 --> 00:15:42,170

well so you're kind of now like a rock

388

00:15:45,820 --> 00:15:44,300

star artist in some ways because of

389

00:15:47,380 --> 00:15:45,830

creating these graphic history series

390

00:15:49,120 --> 00:15:47,390

what is it like to

391

00:15:51,699 --> 00:15:49,130

to a scientific conference and have

392

00:15:55,150 --> 00:15:51,709

scientists want your signature on their

393

00:15:57,069 --> 00:15:55,160

pictures that you created of them it's a

394

00:15:59,019 --> 00:15:57,079

little strange but it's fun

395

00:16:00,759 --> 00:15:59,029

now the conferences are a ton of thought

396

00:16:02,170 --> 00:16:00,769

them and my favorite thing is actually

397

00:16:03,639 --> 00:16:02,180

going around and getting this the the

398

00:16:05,740 --> 00:16:03,649

autographs of the different scientists

399

00:16:07,420 --> 00:16:05,750

there in the issue and I kind of

400

00:16:09,460 --> 00:16:07,430

encourage any any kids and stuff they

401  
00:16:12,190 --> 00:16:09,470  
come for the table and pick up issues to

402  
00:16:13,509 --> 00:16:12,200  
to go around and collect signatures from

403  
00:16:16,690 --> 00:16:13,519  
the scientists that are there because

404  
00:16:18,880 --> 00:16:16,700  
and it's also like you know for kind of

405  
00:16:20,380 --> 00:16:18,890  
early career people and students and

406  
00:16:22,900 --> 00:16:20,390  
things it's a it's a fun way to kind of

407  
00:16:26,680 --> 00:16:22,910  
break the ice with some of these you

408  
00:16:27,940 --> 00:16:26,690  
know big-name researchers that you kind

409  
00:16:30,670 --> 00:16:27,950  
of look up to for their research and

410  
00:16:32,079 --> 00:16:30,680  
stuff but you know sometimes it's a it's

411  
00:16:34,060 --> 00:16:32,089  
a little awkward going up and starting a

412  
00:16:35,710 --> 00:16:34,070  
conversation with people I think it's

413  
00:16:38,829 --> 00:16:35,720

been pretty useful for that and that's

414

00:16:40,150 --> 00:16:38,839

that's super fun to see oh yeah I recall

415

00:16:42,280 --> 00:16:40,160

that feeling as a young undergraduate

416

00:16:44,050 --> 00:16:42,290

student having a bit of the the you know

417

00:16:45,639 --> 00:16:44,060

the the the star shocked feeling when

418

00:16:47,380 --> 00:16:45,649

you go up to some of these Road around

419

00:16:49,740 --> 00:16:47,390

researchers so having an end with a

420

00:16:52,300 --> 00:16:49,750

graphic history series is pretty awesome

421

00:16:54,880 --> 00:16:52,310

can you tell us then for the audience

422

00:16:55,900 --> 00:16:54,890

some of your process maybe that maybe

423

00:16:57,579 --> 00:16:55,910

especially for those who don't really

424

00:17:00,189 --> 00:16:57,589

know what it's like to create something

425

00:17:02,710 --> 00:17:00,199

like this how long does it take you to

426  
00:17:05,949 --> 00:17:02,720  
create one issue and what is the process

427  
00:17:09,490 --> 00:17:05,959  
like from start to finish for you um I

428  
00:17:10,960 --> 00:17:09,500  
mean you've been kind of I guess it's

429  
00:17:12,370 --> 00:17:10,970  
been kind of like on a yearly schedule

430  
00:17:14,829 --> 00:17:12,380  
that we've been releasing either a new

431  
00:17:17,020 --> 00:17:14,839  
issue or updated versions of different

432  
00:17:18,970 --> 00:17:17,030  
issues because we've been updating for

433  
00:17:21,069 --> 00:17:18,980  
instance issue 2 along with you know the

434  
00:17:23,890 --> 00:17:21,079  
different the curiosity launched in the

435  
00:17:26,370 --> 00:17:23,900  
landing and there'll be a new kind of

436  
00:17:28,539 --> 00:17:26,380  
one probably from Mars 2020 so that's

437  
00:17:31,900 --> 00:17:28,549  
kind of concurrently working on that in

438  
00:17:33,190 --> 00:17:31,910

the next issues well so yeah I mean it

439

00:17:35,530 --> 00:17:33,200

stuck with the research it's the blend

440

00:17:37,810 --> 00:17:35,540

of script writing and that that takes a

441

00:17:41,380 --> 00:17:37,820

good amount of time and that probably

442

00:17:42,730 --> 00:17:41,390

takes a lot of time is is kind of

443

00:17:46,210 --> 00:17:42,740

contacting the scientists and getting

444

00:17:47,470 --> 00:17:46,220

input from them and then I start to all

445

00:17:49,900 --> 00:17:47,480

the get works done by hand

446

00:17:52,090 --> 00:17:49,910

it's a pedestal one ink up to that point

447

00:17:53,560 --> 00:17:52,100

like once it's all inked then it's

448

00:17:56,409 --> 00:17:53,570

digitized then I do all the coloring and

449

00:17:59,080 --> 00:17:56,419

stuff digitally but after that after the

450

00:18:00,040 --> 00:17:59,090

kind of draft drawings are done then we

451

00:18:01,720 --> 00:18:00,050

send it around to the

452

00:18:04,000 --> 00:18:01,730

the different scientists that are in the

453

00:18:06,100 --> 00:18:04,010

issue and get their approval on you know

454

00:18:08,320 --> 00:18:06,110

their likeness and the words that

455

00:18:10,090 --> 00:18:08,330

they're saying and that can be the

456

00:18:12,190 --> 00:18:10,100

longest process of getting all the

457

00:18:14,050 --> 00:18:12,200

permissions getting people you know to

458

00:18:16,660 --> 00:18:14,060

to get back to you for one thing but

459

00:18:20,380 --> 00:18:16,670

also a lot of people you know it's

460

00:18:23,980 --> 00:18:20,390

difficult to describe research in three

461

00:18:27,370 --> 00:18:23,990

panels that has taken 20 years and

462

00:18:31,090 --> 00:18:27,380

multiple multiple publications to get to

463

00:18:32,320 --> 00:18:31,100

the point it's at so you know scientists

464

00:18:35,320 --> 00:18:32,330

always feel that stuff's being left out

465

00:18:37,210 --> 00:18:35,330

and they want three pages of scientific

466

00:18:39,430 --> 00:18:37,220

text to explain what they're trying to

467

00:18:40,960 --> 00:18:39,440

say but that's the fun part of the

468

00:18:43,330 --> 00:18:40,970

comics and that's that that's the that's

469

00:18:46,570 --> 00:18:43,340

the reason for doing it and we wouldn't

470

00:18:49,240 --> 00:18:46,580

put references in the back so that's

471

00:18:50,350 --> 00:18:49,250

awesome yeah I know that feeling from

472

00:18:53,590 --> 00:18:50,360

scientists they want to give you

473

00:18:55,540 --> 00:18:53,600

everything in one in one full scoop but

474

00:18:56,980 --> 00:18:55,550

you know as a science communicator then

475

00:18:58,870 --> 00:18:56,990

you know we have to take these materials

476

00:19:00,850 --> 00:18:58,880

and parse them down to something

477

00:19:02,260 --> 00:19:00,860

understandable so it's it's really cool

478

00:19:05,260 --> 00:19:02,270

how you've done that so far with these

479

00:19:07,060 --> 00:19:05,270

seven issues in the astrobiology series

480

00:19:08,920 --> 00:19:07,070

I do want to say to our audience

481

00:19:11,860 --> 00:19:08,930

watching at home you can ask questions

482

00:19:14,350 --> 00:19:11,870

right now for dr. Gronstal using hashtag

483

00:19:15,970 --> 00:19:14,360

ask asked row bio on Twitter or you can

484

00:19:18,490 --> 00:19:15,980

just ask questions directly in the

485

00:19:20,020 --> 00:19:18,500

second net chat or on the NASA

486

00:19:21,730 --> 00:19:20,030

Astrobiology Facebook page if you're

487

00:19:23,980 --> 00:19:21,740

watching there you have the chat box as

488

00:19:25,920 --> 00:19:23,990

well those questions will then come to

489

00:19:28,240 --> 00:19:25,930

me for a little bit later in our show

490

00:19:29,470 --> 00:19:28,250

before we move to that point though I'd

491

00:19:32,140 --> 00:19:29,480

love to talk a bit more just about what

492

00:19:33,940 --> 00:19:32,150

your life is like in general I know that

493

00:19:35,350 --> 00:19:33,950

we have some videos that that our

494

00:19:37,390 --> 00:19:35,360

producer Mike will put up for us to

495

00:19:42,280 --> 00:19:37,400

watch here for instance of you

496

00:19:44,920 --> 00:19:42,290

wakeboarding what's that like oh my grip

497

00:19:46,450 --> 00:19:44,930

kind of around a lake in Iowa so that

498

00:19:47,890 --> 00:19:46,460

was that was part of my my childhood

499

00:19:49,720 --> 00:19:47,900

growing up is fishing and wakeboarding

500

00:19:52,120 --> 00:19:49,730

and waterskiing at first and then

501  
00:19:54,430 --> 00:19:52,130  
wakeboarding and I've kind of a core

502  
00:19:55,870 --> 00:19:54,440  
group of childhood friends that we spend

503  
00:19:57,220 --> 00:19:55,880  
a lot of time on the water and still

504  
00:19:59,230 --> 00:19:57,230  
when I try to get back there in the

505  
00:20:01,300 --> 00:19:59,240  
summers and and get on the boat with

506  
00:20:03,970 --> 00:20:01,310  
everybody it broke my ankle about a year

507  
00:20:06,700 --> 00:20:03,980  
ago wakeboarding so that sounds probably

508  
00:20:09,340 --> 00:20:06,710  
back is back on it this summer so nice

509  
00:20:10,630 --> 00:20:09,350  
yeah I grew up waterskiing but I tried

510  
00:20:12,850 --> 00:20:10,640  
wakeboarding and could never figure it

511  
00:20:13,510 --> 00:20:12,860  
out it just seems so weird to me

512  
00:20:16,570 --> 00:20:13,520  
compared to what

513  
00:20:18,550 --> 00:20:16,580

skiing yeah although that if we figured

514

00:20:21,250 --> 00:20:18,560

out this summer at the friend Kevin we

515

00:20:22,930 --> 00:20:21,260

actually took a class with like this

516

00:20:25,750 --> 00:20:22,940

sixteen-year-old kid that was explaining

517

00:20:28,810 --> 00:20:25,760

to us how to wakeboard and after you

518

00:20:31,740 --> 00:20:28,820

know 20 years of teaching ourselves I

519

00:20:36,670 --> 00:20:31,750

kind of know why I broke my ankle

520

00:20:38,290 --> 00:20:36,680

interesting snowboarding ID snowboarded

521

00:20:41,710 --> 00:20:38,300

for nearly 20 years before I took a

522

00:20:43,720 --> 00:20:41,720

class with my young cousin and she

523

00:20:45,960 --> 00:20:43,730

taught me everything I was doing wrong

524

00:20:47,950 --> 00:20:45,970

for two decades and how to fix it so

525

00:20:49,480 --> 00:20:47,960

even some of us who are getting a little

526

00:20:51,180 --> 00:20:49,490

bit old an age you know can still learn

527

00:20:53,080 --> 00:20:51,190

great new things from young people

528

00:20:55,960 --> 00:20:53,090

teaching and mentorship can be very

529

00:20:58,150 --> 00:20:55,970

important and on that topic have you had

530

00:20:59,440 --> 00:20:58,160

any any really important mentors in your

531

00:21:01,270 --> 00:20:59,450

life you mentioned in high school you

532

00:21:03,790 --> 00:21:01,280

had a great biology teacher you had a

533

00:21:04,900 --> 00:21:03,800

great theater teacher what other mentors

534

00:21:06,810 --> 00:21:04,910

have you had in your life that have

535

00:21:09,580 --> 00:21:06,820

really helped you to develop your career

536

00:21:11,110 --> 00:21:09,590

there's been a lot I mean starting with

537

00:21:14,950 --> 00:21:11,120

my parents my mom my mom and dad were

538

00:21:16,150 --> 00:21:14,960

both very very artistic people and my

539

00:21:19,500 --> 00:21:16,160

dad was big into computer programming

540

00:21:24,220 --> 00:21:19,510

and stuff early on he's also a musician

541

00:21:26,080 --> 00:21:24,230

and yeah then a lot of family you know

542

00:21:28,300 --> 00:21:26,090

like heard a lot of powerful powerful

543

00:21:30,670 --> 00:21:28,310

family figures in my life my grandmother

544

00:21:32,980 --> 00:21:30,680

and my grandmother's sister I mean some

545

00:21:35,050 --> 00:21:32,990

but um yeah and then just some amazing

546

00:21:37,750 --> 00:21:35,060

teachers my remember my third grade

547

00:21:39,790 --> 00:21:37,760

teacher mrs. Edwards was she had a group

548

00:21:42,130 --> 00:21:39,800

of us that were very interested in math

549

00:21:43,630 --> 00:21:42,140

and she kind of pulled us aside and

550

00:21:45,430 --> 00:21:43,640

stuck us at her own table and gave us

551  
00:21:47,140 --> 00:21:45,440  
you know 6th grade math books and let us

552  
00:21:50,650 --> 00:21:47,150  
teach ourselves and that kind of thing

553  
00:21:53,230 --> 00:21:50,660  
so she yeah she actually that was that

554  
00:21:54,790 --> 00:21:53,240  
was a big encouragement and both in kind

555  
00:21:57,070 --> 00:21:54,800  
of independent learning and and just

556  
00:21:59,740 --> 00:21:57,080  
having somebody recognize your interest

557  
00:22:01,570 --> 00:21:59,750  
and then push you along in it um yeah oh

558  
00:22:05,020 --> 00:22:01,580  
my my biology teacher in high school a

559  
00:22:06,640 --> 00:22:05,030  
theatre teacher in high school um that's

560  
00:22:09,100 --> 00:22:06,650  
interesting you can get other incredible

561  
00:22:12,790 --> 00:22:09,110  
people like along my career I mentioned

562  
00:22:15,010 --> 00:22:12,800  
you know Kathleen yes I know you found

563  
00:22:17,680 --> 00:22:15,020

in Australia and Kathleen canal at NASA

564

00:22:20,260 --> 00:22:17,690

and when you got married tech now and

565

00:22:23,140 --> 00:22:20,270

you know who is Charles cacao my PhD

566

00:22:24,850 --> 00:22:23,150

advisor just just a lot of incredible

567

00:22:26,380 --> 00:22:24,860

people and it's I can't you know stress

568

00:22:31,840 --> 00:22:26,390

how important

569

00:22:33,250 --> 00:22:31,850

regard and that's one thing people

570

00:22:35,080 --> 00:22:33,260

always make him said there's there's

571

00:22:38,680 --> 00:22:35,090

opportunities for you to take and

572

00:22:39,490 --> 00:22:38,690

encourage you to take them definitely

573

00:22:41,050 --> 00:22:39,500

that's great

574

00:22:42,520 --> 00:22:41,060

it's nice it's always fun to hear you

575

00:22:43,510 --> 00:22:42,530

know people's stories of who's inspired

576

00:22:45,610 --> 00:22:43,520

them and who's worked with them in their

577

00:22:49,030 --> 00:22:45,620

lives to help them find successful

578

00:22:50,470 --> 00:22:49,040

careers before we move into our question

579

00:22:52,210 --> 00:22:50,480

answer section there's a few more things

580

00:22:53,710 --> 00:22:52,220

I want to talk about with you one I

581

00:22:55,780 --> 00:22:53,720

understand we have a video that we're

582

00:22:57,910 --> 00:22:55,790

going to show here of you on parabolic

583

00:23:00,010 --> 00:22:57,920

flights how did you get into the

584

00:23:02,140 --> 00:23:00,020

proposition of doing that that sounds so

585

00:23:03,400 --> 00:23:02,150

awesome oh that was it was incredible I

586

00:23:05,740 --> 00:23:03,410

mean it was that was part of my master's

587

00:23:07,440 --> 00:23:05,750

program I was a team of us that had a

588

00:23:10,600 --> 00:23:07,450

developed an experiment looking at

589

00:23:12,760 --> 00:23:10,610

microbial myth then motility of

590

00:23:15,730 --> 00:23:12,770

spirulina and microgravity and it was

591

00:23:18,220 --> 00:23:15,740

selected to the European parabolic

592

00:23:20,710 --> 00:23:18,230

flight campaign oh yeah just an

593

00:23:22,240 --> 00:23:20,720

incredible experience that's so awesome

594

00:23:24,190 --> 00:23:22,250

I'm so jealous I haven't had a chance to

595

00:23:25,900 --> 00:23:24,200

do it yet myself and it looks so cool

596

00:23:27,180 --> 00:23:25,910

that feeling of feeling apparent

597

00:23:29,710 --> 00:23:27,190

weightlessness inside of an airplane

598

00:23:31,780 --> 00:23:29,720

yeah I mean it's it's bizarre because

599

00:23:32,740 --> 00:23:31,790

it's almost it's a bit of a feeling that

600

00:23:34,810 --> 00:23:32,750

you get at the top of a roller coaster

601  
00:23:37,480 --> 00:23:34,820  
you know but then it just keeps going

602  
00:23:40,000 --> 00:23:37,490  
and there is something weirdly familiar

603  
00:23:42,100 --> 00:23:40,010  
about it I don't know if it's you know

604  
00:23:43,360 --> 00:23:42,110  
harkens back to swimming or floating and

605  
00:23:44,770 --> 00:23:43,370  
wall you know but it's just there is

606  
00:23:46,720 --> 00:23:44,780  
something kind of familiar about it and

607  
00:23:50,250 --> 00:23:46,730  
it's also when you're doing the pair of

608  
00:23:52,540 --> 00:23:50,260  
parabolas you have kind of the period of

609  
00:23:53,950 --> 00:23:52,550  
increased gravity as well or some

610  
00:23:55,450 --> 00:23:53,960  
simulated increased gravity where you're

611  
00:23:56,680 --> 00:23:55,460  
pressed against the floor and there's a

612  
00:23:58,960 --> 00:23:56,690  
couple other videos of like trying to do

613  
00:24:00,610 --> 00:23:58,970

sit-ups when that's happening and things

614

00:24:01,960 --> 00:24:00,620

and there was one one of the parabolas

615

00:24:04,960 --> 00:24:01,970

when I got to go in the cockpit with the

616

00:24:06,520 --> 00:24:04,970

pilot which was crazy cuz you're the

617

00:24:07,630 --> 00:24:06,530

planes like pointed straight up and

618

00:24:09,730 --> 00:24:07,640

you're just looking at sky and then

619

00:24:13,630 --> 00:24:09,740

swings and you just see the horizon you

620

00:24:16,870 --> 00:24:13,640

and then it's just ocean that sounds

621

00:24:19,270 --> 00:24:16,880

kind of terrifying - yeah there's no

622

00:24:20,920 --> 00:24:19,280

windows in the actual you know it's

623

00:24:22,720 --> 00:24:20,930

fuselage of the plane so you can't see

624

00:24:25,150 --> 00:24:22,730

that when you're actually in there in

625

00:24:27,310 --> 00:24:25,160

the flight but when you'd have a lot

626

00:24:29,560 --> 00:24:27,320

more accidents inside the airplane if

627

00:24:30,790 --> 00:24:29,570

that was the case then yeah yeah yeah

628

00:24:32,380 --> 00:24:30,800

and I was lucky I didn't I didn't get

629

00:24:34,390 --> 00:24:32,390

sick or anything so there were a couple

630

00:24:36,690 --> 00:24:34,400

people that spent the whole time in the

631

00:24:42,880 --> 00:24:36,700

back in the closed room

632

00:24:44,170 --> 00:24:42,890

trying to catch there you know before we

633

00:24:46,420 --> 00:24:44,180

move on to our question and answer

634

00:24:46,870 --> 00:24:46,430

session with the audience one more

635

00:24:48,640 --> 00:24:46,880

question

636

00:24:50,890 --> 00:24:48,650

I understand that that there is a plan

637

00:24:52,570 --> 00:24:50,900

right now for issue number eight of the

638

00:24:54,820 --> 00:24:52,580

astrobiology graphic history series

639

00:24:57,640 --> 00:24:54,830

could you give us a little peek into

640

00:24:59,260 --> 00:24:57,650

what that might be about oh yeah I think

641

00:25:01,270 --> 00:24:59,270

I think we're kind of narrowing it down

642

00:25:05,380 --> 00:25:01,280

and I'm I'm pushing for kind of bio

643

00:25:07,930 --> 00:25:05,390

signatures and that's sort of a big area

644

00:25:09,190 --> 00:25:07,940

of of research right now it got the you

645

00:25:12,340 --> 00:25:09,200

know the life detection ladder that the

646

00:25:14,530 --> 00:25:12,350

program has been working on and and it's

647

00:25:16,660 --> 00:25:14,540

a big push in the research so it's also

648

00:25:18,340 --> 00:25:16,670

part of but then the new reorganization

649

00:25:20,710 --> 00:25:18,350

with the arts the research coordination

650

00:25:22,660 --> 00:25:20,720

that works at the program I think um I

651  
00:25:25,120 --> 00:25:22,670  
think focusing a couple issues on those

652  
00:25:27,760 --> 00:25:25,130  
we've had the one issue that covers sort

653  
00:25:29,410 --> 00:25:27,770  
of Nexus and exoplanets and things and

654  
00:25:31,810 --> 00:25:29,420  
and the the previous issue is prebiotic

655  
00:25:35,820 --> 00:25:31,820  
chemistry in origin of life so that's

656  
00:25:38,860 --> 00:25:35,830  
the the pc3 marcia and i think i think

657  
00:25:40,690 --> 00:25:38,870  
moving into like the the network for

658  
00:25:44,050 --> 00:25:40,700  
life detection might be like a good

659  
00:25:46,120 --> 00:25:44,060  
thing and a good way of explaining that

660  
00:25:47,620 --> 00:25:46,130  
sort of how the research coordination

661  
00:25:50,590 --> 00:25:47,630  
networks are gonna help further the

662  
00:25:52,660 --> 00:25:50,600  
science and it's awesome it's yeah I

663  
00:25:54,550 --> 00:25:52,670

myself a help out with some stuff for

664

00:25:57,400 --> 00:25:54,560

there unfold of the network for life

665

00:25:59,020 --> 00:25:57,410

detection and so I'm curious to see who

666

00:26:02,130 --> 00:25:59,030

all from and fold and the Center for

667

00:26:04,900 --> 00:26:02,140

life detection end up in that issue so I

668

00:26:08,050 --> 00:26:04,910

your your permissions right now to use

669

00:26:10,300 --> 00:26:08,060

your likeness then my permission to use

670

00:26:11,590 --> 00:26:10,310

my likeness I think with the beard

671

00:26:14,710 --> 00:26:11,600

people did kind of notice it right away

672

00:26:17,050 --> 00:26:14,720

anyway even though I now have a child at

673

00:26:19,440 --> 00:26:17,060

home he's almost four months old he's

674

00:26:22,030 --> 00:26:19,450

been slowly pulling out handfuls and so

675

00:26:25,570 --> 00:26:22,040

we'll see for our audience how much

676

00:26:27,430 --> 00:26:25,580

longer the beard lasts so for everyone

677

00:26:28,930 --> 00:26:27,440

watching please remember use hashtag ask

678

00:26:30,670 --> 00:26:28,940

asked your bio on Twitter to ask

679

00:26:32,560 --> 00:26:30,680

questions or use the chat since egg and

680

00:26:35,140 --> 00:26:32,570

net or on Facebook on the NASA

681

00:26:36,600 --> 00:26:35,150

Astrobiology page and we'll open it up

682

00:26:39,910 --> 00:26:36,610

now to some questions from the audience

683

00:26:42,520 --> 00:26:39,920

we'll start off with one from dr.

684

00:26:45,100 --> 00:26:42,530

Lawrence Tyler who's mouska mirror at

685

00:26:47,080 --> 00:26:45,110

Twitter and she wants to know what made

686

00:26:49,090 --> 00:26:47,090

you decide to transition from scientific

687

00:26:52,270 --> 00:26:49,100

research to art we discussed

688

00:26:55,150 --> 00:26:52,280

a little bit was the choice difficult

689

00:26:56,740 --> 00:26:55,160

making this transition and do you have

690

00:26:58,630 --> 00:26:56,750

any advice for people who are now

691

00:27:03,460 --> 00:26:58,640

considering leaving research and

692

00:27:06,580 --> 00:27:03,470

academia for other careers hmm yeah

693

00:27:07,870 --> 00:27:06,590

that's a big question I mean for me for

694

00:27:10,000 --> 00:27:07,880

me it was just a matter of opportunity

695

00:27:11,740 --> 00:27:10,010

and then and the you know the

696

00:27:15,880 --> 00:27:11,750

opportunity came up for me to kind of

697

00:27:19,180 --> 00:27:15,890

pursue science art and you know I ran

698

00:27:21,159 --> 00:27:19,190

with it cuz it thing it's added like a

699

00:27:24,279 --> 00:27:21,169

place where I could actually contribute

700

00:27:25,510 --> 00:27:24,289

quite a bit so yeah and I know that's

701  
00:27:27,220 --> 00:27:25,520  
not saying that I wouldn't go back into

702  
00:27:29,470 --> 00:27:27,230  
research at some point or anything like

703  
00:27:32,950 --> 00:27:29,480  
that I my life has kind of been a string

704  
00:27:35,470 --> 00:27:32,960  
of decisions based on what sounds

705  
00:27:36,840 --> 00:27:35,480  
interesting and where I'm gonna learn

706  
00:27:40,779 --> 00:27:36,850  
the most

707  
00:27:41,980 --> 00:27:40,789  
and yeah that's like advice wise I mean

708  
00:27:44,710 --> 00:27:41,990  
really think about why you want to make

709  
00:27:45,850 --> 00:27:44,720  
that transition you know is there is

710  
00:27:47,770 --> 00:27:45,860  
there a reason you're unhappy and

711  
00:27:50,320 --> 00:27:47,780  
researchers are you missing something

712  
00:27:51,520 --> 00:27:50,330  
with it because there are plenty of

713  
00:27:55,090 --> 00:27:51,530

opportunities as well to stay in

714

00:27:58,169 --> 00:27:55,100

research and and also you know do art as

715

00:28:01,990 --> 00:27:58,179

outreach and that sort of thing and and

716

00:28:04,299 --> 00:28:02,000

you know if you are in a situation where

717

00:28:06,909 --> 00:28:04,309

you're unhappy in your work environment

718

00:28:08,080 --> 00:28:06,919

or something with research then also

719

00:28:09,250 --> 00:28:08,090

reach out to people and talk about why

720

00:28:11,560 --> 00:28:09,260

that is and maybe things that you could

721

00:28:12,760 --> 00:28:11,570

change that wakes it's a shame to kind

722

00:28:15,220 --> 00:28:12,770

of fall out of the research end of

723

00:28:17,260 --> 00:28:15,230

things you know and I do try to kind of

724

00:28:19,659 --> 00:28:17,270

keep up some of my own personal research

725

00:28:22,149 --> 00:28:19,669

as well but I don't have a lot of time

726

00:28:26,649 --> 00:28:22,159

at the moment but one of these days

727

00:28:28,060 --> 00:28:26,659

maybe that's awesome yeah I mean I might

728

00:28:29,950 --> 00:28:28,070

soften that kind of boat to where I

729

00:28:32,289 --> 00:28:29,960

still like to do some of my own research

730

00:28:33,640 --> 00:28:32,299

but I'm focusing so much more now on

731

00:28:35,380 --> 00:28:33,650

communicating science and sharing

732

00:28:36,669 --> 00:28:35,390

science with the public and you know you

733

00:28:38,649 --> 00:28:36,679

do have to consider where your time is

734

00:28:40,450 --> 00:28:38,659

placed for sure

735

00:28:42,520 --> 00:28:40,460

our next question comes from Kashi

736

00:28:46,480 --> 00:28:42,530

Schnapp who is a longtime friend of the

737

00:28:49,539 --> 00:28:46,490

show and background contest winner Kashi

738

00:28:51,690 --> 00:28:49,549

she asks in my country I saw many

739

00:28:55,240 --> 00:28:51,700

students giving up their passion for art

740

00:28:56,350 --> 00:28:55,250

just to go for science as a career they

741

00:28:57,760 --> 00:28:56,360

think that if they can't if they

742

00:29:00,310 --> 00:28:57,770

continue art and they can't follow

743

00:29:02,500 --> 00:29:00,320

science so what would you say to those

744

00:29:04,180 --> 00:29:02,510

kinds of students who feel like

745

00:29:05,970 --> 00:29:04,190

that if they continue in an artistic

746

00:29:07,960 --> 00:29:05,980

endeavor that they actually can't then

747

00:29:11,200 --> 00:29:07,970

progress in any kind of scientific

748

00:29:13,600 --> 00:29:11,210

endeavor um I would never tell them to

749

00:29:15,480 --> 00:29:13,610

rethink that I think that you know never

750

00:29:19,120 --> 00:29:15,490

give up your art for one thing like it's

751

00:29:21,750 --> 00:29:19,130

you know our art has an amazing kind of

752

00:29:24,130 --> 00:29:21,760

therapeutic thing to be doing and and

753

00:29:25,990 --> 00:29:24,140

arts important to put out in the world

754

00:29:30,900 --> 00:29:26,000

as well so I've never it never set that

755

00:29:33,070 --> 00:29:30,910

aside and almost like followed if I

756

00:29:34,360 --> 00:29:33,080

would say to only follow science if

757

00:29:35,770 --> 00:29:34,370

you're passionate about it to in the

758

00:29:39,940 --> 00:29:35,780

same way if I'll follow your passions

759

00:29:41,170 --> 00:29:39,950

don't don't let you know job prospects

760

00:29:44,800 --> 00:29:41,180

and that thing dictate your future

761

00:29:47,470 --> 00:29:44,810

because those prospects change with time

762

00:29:50,050 --> 00:29:47,480

as well so I think if you if you enjoy

763

00:29:51,490 --> 00:29:50,060

what you're doing and you focus on

764

00:29:54,280 --> 00:29:51,500

learning through it and getting better

765

00:29:58,360 --> 00:29:54,290

at what you enjoy then you'll find a

766

00:30:00,670 --> 00:29:58,370

nice thanks it's awesome yeah I can

767

00:30:02,980 --> 00:30:00,680

greet that entirely because she actually

768

00:30:07,330 --> 00:30:02,990

has a second question it's a little

769

00:30:09,490 --> 00:30:07,340

broader she'd like to know and this is

770

00:30:10,600 --> 00:30:09,500

kind of meta for you in consideration of

771

00:30:12,910 --> 00:30:10,610

what you're currently doing with with

772

00:30:15,940 --> 00:30:12,920

the graphic history series do you feel

773

00:30:17,500 --> 00:30:15,950

like creating this art has helped you to

774

00:30:21,610 --> 00:30:17,510

spread scientific understanding and

775

00:30:23,620 --> 00:30:21,620

awareness in the world yeah absolutely I

776

00:30:25,390 --> 00:30:23,630

mean I've got a lot of wonderful

777

00:30:28,120 --> 00:30:25,400

feedback from people about it and I

778

00:30:31,390 --> 00:30:28,130

think that particularly the illustrative

779

00:30:33,460 --> 00:30:31,400

form is really suited to science and I

780

00:30:34,810 --> 00:30:33,470

can in a way you know as as humans we've

781

00:30:37,900 --> 00:30:34,820

been telling stories through

782

00:30:41,530 --> 00:30:37,910

illustration for all of history but um I

783

00:30:46,240 --> 00:30:41,540

think that that the way that science is

784

00:30:47,940 --> 00:30:46,250

often taught and in education you know

785

00:30:51,670 --> 00:30:47,950

it's the textbook style teaching and

786

00:30:55,870 --> 00:30:51,680

kind of not everybody learns well that

787

00:30:59,380 --> 00:30:55,880

way I think that by using comic art you

788

00:31:01,750 --> 00:30:59,390

can approach one subject visually and

789

00:31:03,190 --> 00:31:01,760

through the words and it's your as

790

00:31:05,470 --> 00:31:03,200

you're reading it you're learning things

791

00:31:07,420 --> 00:31:05,480

from both of those and that's that's the

792

00:31:08,350 --> 00:31:07,430

you know the brilliant way of doing it

793

00:31:10,510 --> 00:31:08,360

because some people are visual learners

794

00:31:13,300 --> 00:31:10,520

and having the imagery helps and even

795

00:31:15,640 --> 00:31:13,310

you know even if they don't quite

796

00:31:16,060 --> 00:31:15,650

understand the words the big piece that

797

00:31:18,130 --> 00:31:16,070

with the

798

00:31:22,540 --> 00:31:18,140

and it makes some of these bigger

799

00:31:23,140 --> 00:31:22,550

concepts like more approachable that's

800

00:31:25,720 --> 00:31:23,150

excellent

801  
00:31:27,010 --> 00:31:25,730  
now there's also a science of science

802  
00:31:29,440 --> 00:31:27,020  
communication where people are actually

803  
00:31:31,120 --> 00:31:29,450  
trying to figure out what is actually

804  
00:31:33,130 --> 00:31:31,130  
working in communicating science and

805  
00:31:35,800 --> 00:31:33,140  
trying to understand how we're using art

806  
00:31:37,960 --> 00:31:35,810  
and music and speech and these different

807  
00:31:39,370 --> 00:31:37,970  
media for for sharing our messages how

808  
00:31:41,110 --> 00:31:39,380  
they actually function in getting the

809  
00:31:42,460 --> 00:31:41,120  
message across so it's it's always cool

810  
00:31:44,380 --> 00:31:42,470  
to talk to everyone you know who has

811  
00:31:46,630 --> 00:31:44,390  
different passions for all of you

812  
00:31:48,250 --> 00:31:46,640  
watching you know you might not want to

813  
00:31:51,220 --> 00:31:48,260

make art maybe you want to make music or

814

00:31:53,770 --> 00:31:51,230

or maybe you want to go sing or write a

815

00:31:57,430 --> 00:31:53,780

poetry there are various ways various

816

00:31:59,530 --> 00:31:57,440

artistic means for sharing science our

817

00:32:02,170 --> 00:31:59,540

next question comes from at Carrow in

818

00:32:04,900 --> 00:32:02,180

space on Twitter or Caroline Wong a

819

00:32:07,570 --> 00:32:04,910

Caroline wants to know what kinds of

820

00:32:10,060 --> 00:32:07,580

creative creative processes do you use

821

00:32:11,890 --> 00:32:10,070

when there aren't enough data to

822

00:32:14,920 --> 00:32:11,900

illustrate something accurately for the

823

00:32:16,750 --> 00:32:14,930

comics what kinds of conversations for

824

00:32:19,750 --> 00:32:16,760

instance might happen between you and

825

00:32:21,160 --> 00:32:19,760

the scientists when scripting and

826

00:32:24,550 --> 00:32:21,170

storyboarding and putting together these

827

00:32:25,930 --> 00:32:24,560

ideas for what you want to show that

828

00:32:28,180 --> 00:32:25,940

kind of came up in Alaska issue with

829

00:32:30,310 --> 00:32:28,190

with talk about systems chemistry and

830

00:32:32,770 --> 00:32:30,320

things and you know you can't have a

831

00:32:34,270 --> 00:32:32,780

whole issue of just molecules moving

832

00:32:35,800 --> 00:32:34,280

together and you know that's what you

833

00:32:37,810 --> 00:32:35,810

see in a textbook anyways the molecules

834

00:32:38,980 --> 00:32:37,820

kind of drawn and almost reading the

835

00:32:40,740 --> 00:32:38,990

arrows where they go and that sort of

836

00:32:43,510 --> 00:32:40,750

stuff and I think that's kind of how we

837

00:32:44,980 --> 00:32:43,520

landed on the sequence where there's the

838

00:32:47,110 --> 00:32:44,990

synchronized swimming and you get the

839

00:32:49,660 --> 00:32:47,120

scientists and they're colored uniforms

840

00:32:52,510 --> 00:32:49,670

diving to the pool and swimming around

841

00:32:54,820 --> 00:32:52,520

together and yeah I think that I mean I

842

00:32:56,050 --> 00:32:54,830

think those are the those are the

843

00:32:58,240 --> 00:32:56,060

challenging moments but those are also

844

00:32:59,470 --> 00:32:58,250

the most fun and sitting there and kind

845

00:33:02,230 --> 00:32:59,480

of thinking about how to represent that

846

00:33:03,730 --> 00:33:02,240

visually and you know in a way that has

847

00:33:06,610 --> 00:33:03,740

humor in a way that you know is

848

00:33:07,900 --> 00:33:06,620

captivating so you know I look forward

849

00:33:08,920 --> 00:33:07,910

to those moments and it's it's always

850

00:33:11,170 --> 00:33:08,930

fun to kind of get in touch with the

851  
00:33:13,180 --> 00:33:11,180  
scientists and get them you know

852  
00:33:15,250 --> 00:33:13,190  
bouncing back and forth ideas about

853  
00:33:17,470 --> 00:33:15,260  
about whether or not that works and

854  
00:33:19,810 --> 00:33:17,480  
whether or not you know it might not

855  
00:33:21,100 --> 00:33:19,820  
even be accurately showing what's

856  
00:33:25,420 --> 00:33:21,110  
happening but at least it gives an idea

857  
00:33:26,060 --> 00:33:25,430  
of the thought behind it you know and

858  
00:33:28,010 --> 00:33:26,070  
that's like

859  
00:33:30,620 --> 00:33:28,020  
there were dimensions of emergence um

860  
00:33:32,240 --> 00:33:30,630  
and stuff in the last issue two that had

861  
00:33:34,670 --> 00:33:32,250  
aspects of that with the birds and

862  
00:33:36,770 --> 00:33:34,680  
flying and emergent behaviors and that

863  
00:33:41,270 --> 00:33:36,780

sort of thing and that's always kind of

864

00:33:45,830 --> 00:33:41,280

difficult concepts to to represent only

865

00:33:47,090 --> 00:33:45,840

in speech yeah absolutely yeah there's

866

00:33:49,370 --> 00:33:47,100

so many hard concepts out there in

867

00:33:51,470 --> 00:33:49,380

astrobiology from you know just trying

868

00:33:54,410 --> 00:33:51,480

to define life if we even can to things

869

00:33:56,450 --> 00:33:54,420

like emergence that's so cool our next

870

00:33:58,520 --> 00:33:56,460

question comes you like to the show

871

00:33:59,690 --> 00:33:58,530

I'm sorry and even I mean if you can

872

00:34:02,960 --> 00:33:59,700

just kind of figuring out what I think

873

00:34:04,160 --> 00:34:02,970

what life is in its basic form yeah yeah

874

00:34:06,440 --> 00:34:04,170

there's so many things that are so hard

875

00:34:07,850 --> 00:34:06,450

for us to nail down that seemed crucial

876

00:34:11,120 --> 00:34:07,860

and fundamental to understanding

877

00:34:13,100 --> 00:34:11,130

astrobiology our next question comes

878

00:34:16,520 --> 00:34:13,110

from Tom Caruso a friend of the show on

879

00:34:19,990 --> 00:34:16,530

Facebook Tom asks in the world of

880

00:34:22,460 --> 00:34:20,000

science the goal is to flush out details

881

00:34:24,800 --> 00:34:22,470

but with art the hard part is learning

882

00:34:28,040 --> 00:34:24,810

to stop putting too much detail into the

883

00:34:29,450 --> 00:34:28,050

work how do you balance the two when

884

00:34:31,340 --> 00:34:29,460

making your illustrations and

885

00:34:37,240 --> 00:34:31,350

communicating complicated concepts in

886

00:34:42,380 --> 00:34:37,250

astrobiology ooh another good question

887

00:34:45,830 --> 00:34:42,390

yeah I think in my like in the

888

00:34:48,740 --> 00:34:45,840

illustrations it's there's a big balance

889

00:34:51,550 --> 00:34:48,750

to strike between the the detail of the

890

00:34:54,230 --> 00:34:51,560

image and the detail of the words and

891

00:34:57,170 --> 00:34:54,240

also one of the big tricks in in comics

892

00:34:59,390 --> 00:34:57,180

always is is that you can't you don't

893

00:35:01,130 --> 00:34:59,400

want the words to stay what's happening

894

00:35:03,880 --> 00:35:01,140

in the image really like if you have to

895

00:35:06,050 --> 00:35:03,890

if you have to write down you know

896

00:35:07,760 --> 00:35:06,060

so-and-so goes running down the hallway

897

00:35:10,520 --> 00:35:07,770

and then running down the hallway like

898

00:35:13,550 --> 00:35:10,530

them you're unsuccessful in that medium

899

00:35:15,950 --> 00:35:13,560

so it's you have to pay attention to

900

00:35:17,840 --> 00:35:15,960

what the imagery is speaking and what

901  
00:35:20,240 --> 00:35:17,850  
the words are speaking and strike that

902  
00:35:22,400 --> 00:35:20,250  
balance and then and you know you're

903  
00:35:23,720 --> 00:35:22,410  
right like like for imagery this the

904  
00:35:25,250 --> 00:35:23,730  
simpler the better especially when

905  
00:35:26,960 --> 00:35:25,260  
you're dealing with big concepts and

906  
00:35:29,690 --> 00:35:26,970  
stuff like you don't want to get get it

907  
00:35:33,590 --> 00:35:29,700  
it to get too muddled with with too much

908  
00:35:35,450 --> 00:35:33,600  
imagery so I think I've heard I've tried

909  
00:35:36,920 --> 00:35:35,460  
to pare that down a bit in terms like

910  
00:35:39,440 --> 00:35:36,930  
especially in some of the earlier issues

911  
00:35:40,700 --> 00:35:39,450  
using actual NASA imagery in the

912  
00:35:43,520 --> 00:35:40,710  
grounds and that kind of thing and just

913  
00:35:45,890 --> 00:35:43,530

focusing on on simple kind of concepts

914

00:35:47,240 --> 00:35:45,900

in the foreground and it's not you know

915

00:35:48,740 --> 00:35:47,250

it's a nice way to use some of the

916

00:35:52,550 --> 00:35:48,750

beautiful massive imagery that's out

917

00:35:55,760 --> 00:35:52,560

there that's awesome dude you then that

918

00:35:59,930 --> 00:35:55,770

take those NASA images and directly just

919

00:36:01,910 --> 00:35:59,940

create artwork from them not always

920

00:36:03,589 --> 00:36:01,920

sometimes it's just actual like NASA

921

00:36:05,990 --> 00:36:03,599

photography and the like kind of

922

00:36:06,470 --> 00:36:06,000

integrated into the image hmm that's

923

00:36:08,690 --> 00:36:06,480

awesome

924

00:36:11,390 --> 00:36:08,700

our next question also have to do with

925

00:36:14,630 --> 00:36:11,400

with how you create the art how you use

926  
00:36:17,390 --> 00:36:14,640  
the art to share the science Suraj ahoo

927  
00:36:19,130 --> 00:36:17,400  
and Sagan net wants to know if you think

928  
00:36:21,170 --> 00:36:19,140  
that making graphics that tend to be a

929  
00:36:24,200 --> 00:36:21,180  
little bit more on the funny side or

930  
00:36:27,950 --> 00:36:24,210  
humorous would be more interesting to

931  
00:36:32,599 --> 00:36:27,960  
common people I mean it'll be more

932  
00:36:36,349 --> 00:36:32,609  
interesting to me I think I the Kimura

933  
00:36:37,400 --> 00:36:36,359  
is important and I think that humor is

934  
00:36:39,829 --> 00:36:37,410  
not something that's often associated

935  
00:36:41,240 --> 00:36:39,839  
with science so I think it's an

936  
00:36:43,400 --> 00:36:41,250  
excellent opportunity to include some of

937  
00:36:44,690 --> 00:36:43,410  
the humor and to show you know the

938  
00:36:47,059 --> 00:36:44,700

scientists themselves but also show that

939

00:36:48,380 --> 00:36:47,069

they did you know the human aspect of

940

00:36:50,120 --> 00:36:48,390

them and their people and I do have good

941

00:36:53,510 --> 00:36:50,130

sense of humor in and that sort of thing

942

00:36:56,329 --> 00:36:53,520

so um definitely what that way with

943

00:36:58,970 --> 00:36:56,339

there was also aster biobot comic that I

944

00:37:00,790 --> 00:36:58,980

did that uh that was that was all about

945

00:37:05,540 --> 00:37:00,800

the humor but that was kind of done as a

946

00:37:08,210 --> 00:37:05,550

you know short segment news comic in a

947

00:37:12,260 --> 00:37:08,220

sense like three panel kind of weekly

948

00:37:16,250 --> 00:37:12,270

thing so no I think I think I Kimura is

949

00:37:17,870 --> 00:37:16,260

always always a good hook for myself I

950

00:37:19,790 --> 00:37:17,880

do a lot of speaking for for science

951  
00:37:22,010 --> 00:37:19,800  
communication and it's always that fine

952  
00:37:23,180 --> 00:37:22,020  
line of having some humor but not too

953  
00:37:25,819 --> 00:37:23,190  
much because you don't want to lose the

954  
00:37:28,579 --> 00:37:25,829  
message yeah even though I have done

955  
00:37:31,520 --> 00:37:28,589  
stand-up science comedy and that's also

956  
00:37:33,829 --> 00:37:31,530  
quite a blast so good to have the

957  
00:37:35,359 --> 00:37:33,839  
audience laughing with you and so I love

958  
00:37:37,970 --> 00:37:35,369  
the humor that I've seen in various

959  
00:37:40,160 --> 00:37:37,980  
places for communicating science our

960  
00:37:43,220 --> 00:37:40,170  
next question is gonna go more into the

961  
00:37:46,280 --> 00:37:43,230  
science now so so digging back in your

962  
00:37:48,410 --> 00:37:46,290  
science background here reaching nandi

963  
00:37:49,330 --> 00:37:48,420

wants to know from second that wants to

964

00:37:52,540 --> 00:37:49,340

know

965

00:37:55,420 --> 00:37:52,550

which origin of life hypothesis has the

966

00:37:57,580 --> 00:37:55,430

most evidence or at least as far as you

967

00:38:01,630 --> 00:37:57,590

you can tell something like a DNA world

968

00:38:04,390 --> 00:38:01,640

an RNA world protein interaction how do

969

00:38:06,910 --> 00:38:04,400

you how do you kind of fall with the

970

00:38:12,550 --> 00:38:06,920

current considerations of how life might

971

00:38:14,080 --> 00:38:12,560

have started on earth I mean what might

972

00:38:15,520 --> 00:38:14,090

my background is more in Geo

973

00:38:17,590 --> 00:38:15,530

microbiology and doing kind of

974

00:38:19,780 --> 00:38:17,600

subsurface deep subsurface microbiology

975

00:38:23,500 --> 00:38:19,790

so I'm not not an allergen of life

976

00:38:24,820 --> 00:38:23,510

researcher and I just think it's it's a

977

00:38:28,450 --> 00:38:24,830

field that's progressing so much you

978

00:38:30,790 --> 00:38:28,460

have kind of the two you know the people

979

00:38:32,050 --> 00:38:30,800

that were kind of bottom up and starting

980

00:38:33,880 --> 00:38:32,060

from chemistry and looking at how that

981

00:38:36,010 --> 00:38:33,890

may have become life and the people

982

00:38:38,140 --> 00:38:36,020

working backwards from you know life now

983

00:38:40,780 --> 00:38:38,150

and looking back toward Luca and before

984

00:38:44,230 --> 00:38:40,790

that and and trying to meet somewhere in

985

00:38:47,280 --> 00:38:44,240

the middle and and I think that you know

986

00:38:48,750 --> 00:38:47,290

there's there's a lot of

987

00:38:50,640 --> 00:38:48,760

unlike the RNA world of that sort of

988

00:38:53,460 --> 00:38:50,650

theory there was also just very recently

989

00:38:57,180 --> 00:38:53,470

a paper run Christian with krishnamurthi

990

00:39:00,540 --> 00:38:57,190

and some of the people at the out there

991

00:39:02,510 --> 00:39:00,550

that I also kind of showed that that DNA

992

00:39:04,590 --> 00:39:02,520

and RNA could have merged concurrently

993

00:39:06,030 --> 00:39:04,600

so it may not have been one before the

994

00:39:09,830 --> 00:39:06,040

other and may not have been RNA first

995

00:39:11,850 --> 00:39:09,840

necessarily so I think that that that I

996

00:39:13,770 --> 00:39:11,860

think it'll be interesting as we as we

997

00:39:16,320 --> 00:39:13,780

continue kind of explore the solar

998

00:39:19,650 --> 00:39:16,330

system and maybe find evidence of life

999

00:39:21,720 --> 00:39:19,660

elsewhere then that would give us a

1000

00:39:23,490 --> 00:39:21,730

second data point and I'd be a lot

1001  
00:39:25,310 --> 00:39:23,500  
easier to understand the likelihood of

1002  
00:39:29,070 --> 00:39:25,320  
pence per Mia in our own solar system

1003  
00:39:31,160 --> 00:39:29,080  
you know things like like Venus there's

1004  
00:39:34,260 --> 00:39:31,170  
something to travel outward toward Earth

1005  
00:39:35,970 --> 00:39:34,270  
away from the Sun that's trickier than

1006  
00:39:36,750 --> 00:39:35,980  
something kind of moving you know moving

1007  
00:39:40,520 --> 00:39:36,760  
in from Mars

1008  
00:39:43,800 --> 00:39:40,530  
well not impossible but the trickier um

1009  
00:39:45,030 --> 00:39:43,810  
ya know I'm I think first we need to

1010  
00:39:46,880 --> 00:39:45,040  
answer the question about life on Earth

1011  
00:39:49,650 --> 00:39:46,890  
and figuring out what that is and

1012  
00:39:51,210 --> 00:39:49,660  
nailing down the clear way of

1013  
00:39:53,790 --> 00:39:51,220

identifying that in terms of a bio

1014

00:39:55,920 --> 00:39:53,800

signature and then and then start

1015

00:39:57,360 --> 00:39:55,930

branching out and figuring out now what

1016

00:39:58,740 --> 00:39:57,370

other kind of bio signatures might exist

1017

00:40:01,140 --> 00:39:58,750

out there and what are they

1018

00:40:03,900 --> 00:40:01,150

you know what nuances and differences in

1019

00:40:07,290 --> 00:40:03,910

life will might find and even if we you

1020

00:40:08,430 --> 00:40:07,300

know if we identified life on Europa or

1021

00:40:12,270 --> 00:40:08,440

somewhere else like that if it was

1022

00:40:15,060 --> 00:40:12,280

exactly you know DNA based and exactly

1023

00:40:17,520 --> 00:40:15,070

the same as earth-like that would be

1024

00:40:19,320 --> 00:40:17,530

interesting as well I mean you'd never

1025

00:40:24,180 --> 00:40:19,330

be able to say where life in the solar

1026

00:40:25,560 --> 00:40:24,190

system came from first then but now it's

1027

00:40:27,530 --> 00:40:25,570

an interesting question it's it's an

1028

00:40:30,390 --> 00:40:27,540

interesting thought experiment at least

1029

00:40:32,010 --> 00:40:30,400

yeah absolutely yeah I'm always kind of

1030

00:40:33,570 --> 00:40:32,020

curious to see you know what the future

1031

00:40:35,520 --> 00:40:33,580

holds for us actually getting out into

1032

00:40:36,900 --> 00:40:35,530

our and solar system and exploring I

1033

00:40:39,290 --> 00:40:36,910

feel like we're just on the cusp right

1034

00:40:41,580 --> 00:40:39,300

now of doing the coolest stuff yeah um

1035

00:40:42,990 --> 00:40:41,590

so our next question comes from our

1036

00:40:46,800 --> 00:40:43,000

ambassador of the month

1037

00:40:48,660 --> 00:40:46,810

Sejal who wants to know the artwork in

1038

00:40:52,140 --> 00:40:48,670

the script of a NASA Astrobiology

1039

00:40:54,750 --> 00:40:52,150

graphic history books are really amazing

1040

00:40:56,529 --> 00:40:54,760

she says I love prebiotic chemistry and

1041

00:40:58,719 --> 00:40:56,539

the origin of life most issue

1042

00:41:00,999 --> 00:40:58,729

seven they want to know what forms of

1043

00:41:03,939 --> 00:41:01,009

life or extremophiles you imagined to

1044

00:41:10,269 --> 00:41:03,949

potentially be in Europa or in Enceladus

1045

00:41:13,449 --> 00:41:10,279

ooh I guess this is kind of pie in the

1046

00:41:15,039 --> 00:41:13,459

sky if I could have anything yeah well

1047

00:41:23,620 --> 00:41:15,049

then I want like intelligent dolphins

1048

00:41:27,689 --> 00:41:23,630

with I mean I think you know with with

1049

00:41:29,799 --> 00:41:27,699

some of the research that I did my PhD

1050

00:41:33,579 --> 00:41:29,809

that life is deep in the subsurface

1051

00:41:35,679 --> 00:41:33,589

right I mean I think it's very difficult

1052

00:41:37,499 --> 00:41:35,689

on earth to find a place where life

1053

00:41:40,150 --> 00:41:37,509

doesn't exist we find microbes

1054

00:41:42,549 --> 00:41:40,160

everywhere you know and you didn't sign

1055

00:41:44,859 --> 00:41:42,559

nuclear reactors and things and and I

1056

00:41:47,199 --> 00:41:44,869

think that if you could have had an

1057

00:41:48,789 --> 00:41:47,209

origin of life on a place like you're

1058

00:41:50,409 --> 00:41:48,799

open if there's you know there's an

1059

00:41:53,019 --> 00:41:50,419

energy source under underneath and

1060

00:41:56,890 --> 00:41:53,029

there's liquid water and and I think

1061

00:41:58,599 --> 00:41:56,900

you'd you know like microbial life would

1062

00:42:01,359 --> 00:41:58,609

be what I would look for first you know

1063

00:42:05,319 --> 00:42:01,369

always but that's also what I'm I'm

1064

00:42:06,849 --> 00:42:05,329

trained in so to follow on let's just

1065

00:42:09,159 --> 00:42:06,859

have some fun with it so you're an

1066

00:42:12,549 --> 00:42:09,169

artist you you you you know you use your

1067

00:42:15,279 --> 00:42:12,559

imagination to create things say you had

1068

00:42:18,509 --> 00:42:15,289

to create what alien life beyond our

1069

00:42:20,409 --> 00:42:18,519

solar system might most likely be like

1070

00:42:22,569 --> 00:42:20,419

what do you think we're most likely

1071

00:42:25,689 --> 00:42:22,579

going to find out there what kind of

1072

00:42:29,140 --> 00:42:25,699

organisms will we find I mean I think I

1073

00:42:32,259 --> 00:42:29,150

think our best bet is is you know in

1074

00:42:34,870 --> 00:42:32,269

terms of beyond the solar system with

1075

00:42:36,339 --> 00:42:34,880

kind of modern telescopes and future

1076  
00:42:37,779 --> 00:42:36,349  
telescopes and things is atmospheric

1077  
00:42:40,589 --> 00:42:37,789  
signatures you know looking at

1078  
00:42:42,669 --> 00:42:40,599  
atmospheric composition and defining

1079  
00:42:44,439 --> 00:42:42,679  
something that we can say with pretty

1080  
00:42:46,509 --> 00:42:44,449  
good certainty that you know this

1081  
00:42:50,559 --> 00:42:46,519  
atmospheric composition is a signature

1082  
00:42:53,890 --> 00:42:50,569  
of of what we would expect from a hat

1083  
00:42:56,849 --> 00:42:53,900  
inhabited world I don't know how how you

1084  
00:42:59,759 --> 00:42:56,859  
know how close we'll be able to get to

1085  
00:43:02,739 --> 00:42:59,769  
understanding what that life looks like

1086  
00:43:04,839 --> 00:43:02,749  
and of course I'd love to see Star Trek

1087  
00:43:07,390 --> 00:43:04,849  
I'd love to see you know other worlds

1088  
00:43:09,150 --> 00:43:07,400

and have it with with alien life that we

1089

00:43:12,420 --> 00:43:09,160

can interact with them

1090

00:43:14,579 --> 00:43:12,430

communicate with but I think we've got a

1091

00:43:18,029 --> 00:43:14,589

long way to go before her before we had

1092

00:43:20,099 --> 00:43:18,039

the technology to do that well you know

1093

00:43:21,990 --> 00:43:20,109

it's always fun the dream yeah you know

1094

00:43:24,750 --> 00:43:22,000

I myself am a huge science-fiction fan

1095

00:43:27,870 --> 00:43:24,760

yeah I'm curious what what what

1096

00:43:30,539 --> 00:43:27,880

portrayals of aliens in science fiction

1097

00:43:33,029 --> 00:43:30,549

and fantasy through film through

1098

00:43:35,730 --> 00:43:33,039

television through graphic histories

1099

00:43:37,740 --> 00:43:35,740

graphic novels and comic books what do

1100

00:43:41,549 --> 00:43:37,750

you think are like the best portrayal of

1101

00:43:43,920 --> 00:43:41,559

aliens ooh I mean I'm a big Star Trek

1102

00:43:46,079 --> 00:43:43,930

fan and I know huge respect for that

1103

00:43:48,410 --> 00:43:46,089

world that was created and and what they

1104

00:43:51,390 --> 00:43:48,420

tried to do with it in terms of you know

1105

00:43:53,130 --> 00:43:51,400

not having it always about war and stuff

1106

00:43:55,170 --> 00:43:53,140

I was also a big star Wars fan I grew up

1107

00:43:57,930 --> 00:43:55,180

I probably had first three movies

1108

00:43:59,250 --> 00:43:57,940

memorized by the time I was five and I

1109

00:44:02,450 --> 00:43:59,260

think Return of the Jedi was one of the

1110

00:44:05,670 --> 00:44:02,460

first films I saw him at theatres but uh

1111

00:44:11,910 --> 00:44:05,680

how big part see favorites let's say the

1112

00:44:13,519 --> 00:44:11,920

Iron Giant interesting I've never gotten

1113

00:44:16,680 --> 00:44:13,529

giant as an alien I guess you're right

1114

00:44:21,510 --> 00:44:16,690

that one we struck a chord with me and

1115

00:44:23,250 --> 00:44:21,520

that was beautiful that's awesome yeah

1116

00:44:26,190 --> 00:44:23,260

and I think that was also you know I

1117

00:44:29,370 --> 00:44:26,200

think like intelligent robots like that

1118

00:44:32,430 --> 00:44:29,380

that would be fairly realistic thing for

1119

00:44:35,539 --> 00:44:32,440

long long-term space travel and you know

1120

00:44:37,829 --> 00:44:35,549

and that sort of thing as well so what

1121

00:44:41,359 --> 00:44:37,839

so remember that last moment where he's

1122

00:44:44,609 --> 00:44:41,369

flying in the sky whose tears my eyes I

1123

00:44:46,500 --> 00:44:44,619

love it our next question comes from

1124

00:44:50,279 --> 00:44:46,510

someone who goes by the handle faith and

1125

00:44:53,940 --> 00:44:50,289

fury and they say hey uncle Aaron it's

1126  
00:44:58,470 --> 00:44:53,950  
Gabe just wanted to ask what it's like

1127  
00:45:00,029 --> 00:44:58,480  
floating about in space well I didn't

1128  
00:45:02,120 --> 00:45:00,039  
even float it about in space but I did

1129  
00:45:04,140 --> 00:45:02,130  
fly what about on the parabolic flight

1130  
00:45:09,029 --> 00:45:04,150  
incredible and you should definitely try

1131  
00:45:11,010 --> 00:45:09,039  
it sometime Gabe just study study hard

1132  
00:45:14,880 --> 00:45:11,020  
right yeah study hard we will do it to

1133  
00:45:16,620 --> 00:45:14,890  
you float about inside we have another

1134  
00:45:19,200 --> 00:45:16,630  
question here from Sagan net this is

1135  
00:45:20,789 --> 00:45:19,210  
from Harshal Harshal was-- Nick who

1136  
00:45:22,290 --> 00:45:20,799  
wants to know how difficult it is to

1137  
00:45:24,270 --> 00:45:22,300  
convey

1138  
00:45:26,760 --> 00:45:24,280

illustrative concepts to people from

1139

00:45:30,750 --> 00:45:26,770

different backgrounds to understand

1140

00:45:31,860 --> 00:45:30,760

these concepts in astrobiology how do

1141

00:45:34,320 --> 00:45:31,870

you help people from these different

1142

00:45:36,270 --> 00:45:34,330

backgrounds to understand these concepts

1143

00:45:39,000 --> 00:45:36,280

in such a large room of knowledge like

1144

00:45:39,990 --> 00:45:39,010

astrobiology um I mean that's an

1145

00:45:42,240 --> 00:45:40,000

excellent question that is really

1146

00:45:43,320 --> 00:45:42,250

difficult because people have different

1147

00:45:45,080 --> 00:45:43,330

backgrounds and different cultures we

1148

00:45:47,850 --> 00:45:45,090

also have different ways of interpreting

1149

00:45:50,750 --> 00:45:47,860

imagery and in Chinese and I did have

1150

00:45:52,920 --> 00:45:50,760

act as a wonderful opportunity to go and

1151

00:45:55,710 --> 00:45:52,930

talk at a writer's workshop at the

1152

00:45:56,970 --> 00:45:55,720

Navajo Nation and in New Mexico and you

1153

00:45:59,520 --> 00:45:56,980

know Navin oh how I've been telling

1154

00:46:02,400 --> 00:45:59,530

stories with you know pictures pictures

1155

00:46:05,250 --> 00:46:02,410

and images for you know as long as we

1156

00:46:07,320 --> 00:46:05,260

know so that was that was fascinating

1157

00:46:09,090 --> 00:46:07,330

because you know they're better at than

1158

00:46:11,820 --> 00:46:09,100

I could ever be so and all these

1159

00:46:13,680 --> 00:46:11,830

students sort of asking me questions and

1160

00:46:15,510 --> 00:46:13,690

I was supposed to be teaching them

1161

00:46:18,510 --> 00:46:15,520

things and I definitely learned more

1162

00:46:21,810 --> 00:46:18,520

than they did ya know it's a tough

1163

00:46:23,340 --> 00:46:21,820

consideration and I think I mean my and

1164

00:46:24,660 --> 00:46:23,350

I was raised with Marvel Comics in DC

1165

00:46:26,630 --> 00:46:24,670

and I think that that's that's sort of

1166

00:46:30,750 --> 00:46:26,640

there's a language there that exists and

1167

00:46:32,160 --> 00:46:30,760

that's popular culture you know that's

1168

00:46:35,400 --> 00:46:32,170

fairly spread around the world so I

1169

00:46:38,490 --> 00:46:35,410

think that you know like trying to kind

1170

00:46:40,500 --> 00:46:38,500

of stick to that format has been you

1171

00:46:43,650 --> 00:46:40,510

know one of my one of my goals with it

1172

00:46:45,450 --> 00:46:43,660

and just because it's it's a it's sort

1173

00:46:47,970 --> 00:46:45,460

of a visual and storytelling language

1174

00:46:50,190 --> 00:46:47,980

that has been established already rather

1175

00:46:51,390 --> 00:46:50,200

than trying to to reinvent it but I

1176

00:46:53,460 --> 00:46:51,400

would I mean I would love to explore

1177

00:46:58,140 --> 00:46:53,470

kind of other other ways of doing it as

1178

00:47:00,780 --> 00:46:58,150

well and then and it that's hmm coming

1179

00:47:02,040 --> 00:47:00,790

up with ideas now I think you know be

1180

00:47:03,150 --> 00:47:02,050

fun to do some some kind of

1181

00:47:05,820 --> 00:47:03,160

collaborative work with some other

1182

00:47:08,730 --> 00:47:05,830

groups and and see what other ways we

1183

00:47:10,770 --> 00:47:08,740

could we could use yeah that's awesome

1184

00:47:12,210 --> 00:47:10,780

yes I asked an astrobiologist is

1185

00:47:15,810 --> 00:47:12,220

stimulating all kinds of ideas all the

1186

00:47:17,550 --> 00:47:15,820

time um so we have something kind of fun

1187

00:47:19,530 --> 00:47:17,560

for our audience right now who are

1188

00:47:23,250 --> 00:47:19,540

watching live and for those watching on

1189

00:47:24,960 --> 00:47:23,260

YouTube we're gonna show a trailer from

1190

00:47:27,030 --> 00:47:24,970

a video that's being created right now

1191

00:47:29,460 --> 00:47:27,040

for NASA Astrobiology that highlights

1192

00:47:31,260 --> 00:47:29,470

Aaron's work and so specifically

1193

00:47:33,390 --> 00:47:31,270

highlights the creation

1194

00:47:36,720 --> 00:47:33,400

the NASA Astrobiology graphic history

1195

00:47:39,510 --> 00:47:36,730

series sort of give you a short watch of

1196

00:47:42,750 --> 00:47:39,520

the trailer for this upcoming video to

1197

00:47:45,660 --> 00:47:42,760

be released very soon showing dr. Aaron

1198

00:47:47,130 --> 00:47:45,670

Gronstal and his work so I think we're

1199

00:47:57,840 --> 00:47:47,140

ready so we'll have our production crew

1200

00:48:00,660 --> 00:47:57,850

go ahead and roll that trailer I've been

1201  
00:48:01,830 --> 00:48:00,670  
drawing pretty much all my life comic

1202  
00:48:05,640 --> 00:48:01,840  
books were definitely kind of one of my

1203  
00:48:08,010 --> 00:48:05,650  
one of my dreams growing up it was kind

1204  
00:48:10,800 --> 00:48:08,020  
of just self-taught I did kind of joke

1205  
00:48:12,359 --> 00:48:10,810  
that like I finished my my PhD in geo

1206  
00:48:14,400 --> 00:48:12,369  
microbiology and then went back to being

1207  
00:48:19,050 --> 00:48:14,410  
a 14 year old in my pajamas drying

1208  
00:48:20,580 --> 00:48:19,060  
making comics in my bedroom just drawing

1209  
00:48:23,820 --> 00:48:20,590  
and drag and drag until my hands are

1210  
00:48:26,100 --> 00:48:23,830  
shaking and sore like it takes months

1211  
00:48:27,930 --> 00:48:26,110  
sometimes longer for me to kind of look

1212  
00:48:39,000 --> 00:48:27,940  
back see it with fresh eyes and be like

1213  
00:48:41,030 --> 00:48:39,010

oh it actually works definitely looking

1214

00:48:42,990 --> 00:48:41,040  
forward to seeing this new video

1215

00:48:45,300 --> 00:48:43,000  
highlighting the production of the

1216

00:48:49,050 --> 00:48:45,310  
graphic history series with dr. Erin

1217

00:48:50,960 --> 00:48:49,060  
Gronstal so for any of you who are

1218

00:48:54,690 --> 00:48:50,970  
interested you can go online to

1219

00:48:57,810 --> 00:48:54,700  
astrobiology nasa.gov and find all of

1220

00:49:00,210 --> 00:48:57,820  
the graphic history series for free and

1221

00:49:02,010 --> 00:49:00,220  
downloadable so if you go on and go

1222

00:49:03,570 --> 00:49:02,020  
under resources and then graphic

1223

00:49:07,109 --> 00:49:03,580  
histories in the upper right hand corner

1224

00:49:09,090 --> 00:49:07,119  
you can find out you can find all of the

1225

00:49:11,849 --> 00:49:09,100  
different seven issues we have so far as

1226

00:49:14,970 --> 00:49:11,859

well as the the Astro biobot single

1227

00:49:17,520 --> 00:49:14,980

issue so far so dr. Erin grants thaw

1228

00:49:18,480 --> 00:49:17,530

before we leave this episode is there

1229

00:49:24,720 --> 00:49:18,490

anything you'd like to leave our

1230

00:49:27,440 --> 00:49:24,730

audience with as a parting thought um no

1231

00:49:29,310 --> 00:49:27,450

I read it I think just uh

1232

00:49:30,900 --> 00:49:29,320

yeah I would say I would say follow

1233

00:49:33,270 --> 00:49:30,910

follow your passions if you're you know

1234

00:49:34,380 --> 00:49:33,280

I think everybody that's tuned in is

1235

00:49:35,490 --> 00:49:34,390

probably interested in science and

1236

00:49:36,599 --> 00:49:35,500

everything but I'm sure everybody has

1237

00:49:38,849 --> 00:49:36,609

other passions that they're also

1238

00:49:40,890 --> 00:49:38,859

interested look for ways of integrating

1239

00:49:43,190 --> 00:49:40,900

that into your your professional work as

1240

00:49:44,670 --> 00:49:43,200

well because it benefits all of us

1241

00:49:46,049 --> 00:49:44,680

and it's awesome

1242

00:49:47,670 --> 00:49:46,059

thank you very much doctor ground stall

1243

00:49:50,069 --> 00:49:47,680

for joining us for asking

1244

00:49:52,770 --> 00:49:50,079

astrobiologists we really appreciate it

1245

00:49:54,059 --> 00:49:52,780

for our audience at home when you're

1246

00:49:56,370 --> 00:49:54,069

looking through the graphic history

1247

00:49:58,890 --> 00:49:56,380

series if you find some artwork that you

1248

00:50:01,170 --> 00:49:58,900

think really speaks to you or it's just

1249

00:50:03,569 --> 00:50:01,180

really awesome feel free to share it

1250

00:50:05,579 --> 00:50:03,579

with us on twitter at hashtag ask aster

1251

00:50:07,349 --> 00:50:05,589

bio let us know why you think the

1252

00:50:08,910 --> 00:50:07,359

artwork is so awesome or the story is

1253

00:50:10,530 --> 00:50:08,920

too awesome what is it about the graphic

1254

00:50:13,680 --> 00:50:10,540

histories that really makes them so

1255

00:50:15,390 --> 00:50:13,690

exciting for all of you and then I guess

1256

00:50:17,579 --> 00:50:15,400

for ask an astrobiologist this is dr.

1257

00:50:19,500 --> 00:50:17,589

Graham Maus signing off so remember to

1258

00:51:01,060 --> 00:50:19,510

stay curious