AbGradCon 2018

1
00:00:00,260 --> 00:00:10,320
[Music]

2
00:00:15,940 --> 00:00:12,970
it's gonna have to give you guys an

3
00:00:20,170 --> 00:00:15,950
introduction to biology and the greater

4
00:00:22,300 --> 00:00:20,180
context of astrobiology so we can think

5
00:00:24,880 --> 00:00:22,310
about the ball the biologists

6
00:00:26,470 --> 00:00:24,890
contribution or their utility to

7
00:00:28,270 --> 00:00:26,480
astrobiology and I think this is a

8
00:00:31,600 --> 00:00:28,280
really interesting question because I

9
00:00:32,950 --> 00:00:31,610
really don't think that the full

10
00:00:35,290 --> 00:00:32,960
potential of the biologists have been

11
00:00:36,610 --> 00:00:35,300
realized yet and that's really for sort

12
00:00:37,840 --> 00:00:36,620
of the plain reason that we haven't

13
00:00:39,489 --> 00:00:37,850

really found anything yet

14
00:00:42,459 --> 00:00:39,499
so we haven't found any of these guides

15
00:00:43,930 --> 00:00:42,469
or something like this we haven't really

16
00:00:45,309 --> 00:00:43,940
found any life-forms Ector

17
00:00:46,689 --> 00:00:45,319
extraterrestrial life-forms that the

18
00:00:50,229 --> 00:00:46,699
biologists could then go in and CAD or

19
00:00:52,599 --> 00:00:50,239
categorize and characterize but they can

20
00:00:54,610 --> 00:00:52,609
still do some some things so one of the

21
00:00:56,169 --> 00:00:54,620
things biologists can do in the context

22
00:00:58,180 --> 00:00:56,179
of astrobiology is look at the origin of

23
00:01:00,340 --> 00:00:58,190
life on Earth and what that informs us

24
00:01:03,520 --> 00:01:00,350
about the origin of life elsewhere

25
00:01:05,229 --> 00:01:03,530
so obviously the origin of all life way

26
00:01:07,570 --> 00:01:05,239
back seems to tell your life but also

27
00:01:10,510 --> 00:01:07,580
evolution throughout time so eukaryotic

28
00:01:12,190 --> 00:01:10,520
life multicellularity large macro fauna

29
00:01:15,580 --> 00:01:12,200
and then even the evolution of things

30
00:01:16,780 --> 00:01:15,590
like intelligence in biology and so a

31
00:01:19,210 --> 00:01:16,790
few of the talks we're gonna give today

32
00:01:20,530 --> 00:01:19,220
are gonna cover that topic most of them

33
00:01:22,810 --> 00:01:20,540
are gonna center around here at the

34
00:01:25,990 --> 00:01:22,820
beginning but valerio is gonna tell us

35
00:01:30,570 --> 00:01:26,000
about the evolution of biopolymers and

36
00:01:33,460 --> 00:01:30,580
so molecules important to biology mostly

37
00:01:35,050 --> 00:01:33,470
exist as as palmer's so things like DNA

38
00:01:37,540 --> 00:01:35,060

and protein so the strung together

39
00:01:38,680 --> 00:01:37,550
change of monomers but what's

40
00:01:41,500 --> 00:01:38,690
interesting is that a lot of the

41
00:01:43,860 --> 00:01:41,510
monomers that make up present-day

42
00:01:47,560 --> 00:01:43,870
biopolymers are sort of really hard to

43
00:01:50,200 --> 00:01:47,570
assemble under prebiotic conditions and

44
00:01:51,850 --> 00:01:50,210
so a lot of people think that the

45
00:01:53,860 --> 00:01:51,860
monomers that we know and love today are

46
00:01:56,620 --> 00:01:53,870
actually descended from sort of these

47
00:01:59,520 --> 00:01:56,630
these proto monomers that made up proto

48
00:02:02,470 --> 00:01:59,530
polymers of similar but but

49
00:02:05,410 --> 00:02:02,480
fundamentally different molecules the

50
00:02:06,790 --> 00:02:05,420
layers can tell us about that Jose is

51
00:02:08,139 --> 00:02:06,800
then gonna tell us about the origin of

52
00:02:09,940 --> 00:02:08,149
viruses and so this is a really

53
00:02:11,020 --> 00:02:09,950
interesting topic because I don't think

54
00:02:15,490 --> 00:02:11,030
it's one a lot of people think of

55
00:02:17,410 --> 00:02:15,500
everyone so obsessed with with finding

56
00:02:18,880 --> 00:02:17,420
the origin about cellular life where as

57
00:02:21,190 --> 00:02:18,890
you know we have these viruses

58
00:02:23,050 --> 00:02:21,200
that have a huge bearing on curbing

59
00:02:24,640 --> 00:02:23,060
biological populations down from

60
00:02:27,910 --> 00:02:24,650
single-cell bacteria all the way up to

61
00:02:30,220 --> 00:02:27,920
the humans these things that are

62
00:02:34,090 --> 00:02:30,230
technically nonliving a cellular life

63
00:02:36,490 --> 00:02:34,100

forms who have genomes that not only DNA

64
00:02:38,500 --> 00:02:36,500
like all cellular life but also RNA and

65
00:02:40,600 --> 00:02:38,510
so trying to pinpoint how these how

66
00:02:44,110 --> 00:02:40,610
these things evolved why they evolved is

67
00:02:48,930 --> 00:02:44,120
very interesting question in terms of

68
00:02:52,979 --> 00:02:51,790
finally under the umbrella of this topic

69
00:02:56,170 --> 00:02:52,989
Anna's going to talk to us about

70
00:02:59,170 --> 00:02:56,180
membrane membrane formation and this is

71
00:03:02,020 --> 00:02:59,180
a really important step in terms of

72
00:03:06,009 --> 00:03:02,030
going from prebiotic chemistry to

73
00:03:07,360 --> 00:03:06,019
cellular life because sort of we can

74
00:03:08,979 --> 00:03:07,370
think of without a membrane we sort of

75
00:03:10,630 --> 00:03:08,989
have this diffuse prebiotic chemistry

76
00:03:13,259 --> 00:03:10,640
where things are far apart they're not

77
00:03:16,870 --> 00:03:13,269
high concentration molecules that are

78
00:03:18,880 --> 00:03:16,880
reacting with each with each other might

79
00:03:21,190 --> 00:03:18,890
not be doing so in a very fast fashion

80
00:03:23,160 --> 00:03:21,200
but then if you can enclose this in a

81
00:03:25,000 --> 00:03:23,170
membrane you're concentrating and

82
00:03:27,460 --> 00:03:25,010
compartmentalizing these molecules so

83
00:03:29,410 --> 00:03:27,470
that they can have they can interact a

84
00:03:30,840 --> 00:03:29,420
lot more commonly and a lot faster with

85
00:03:33,069 --> 00:03:30,850
each other so you're sort of

86
00:03:35,979 --> 00:03:33,079
exponentially than increasing from that

87
00:03:37,840 --> 00:03:35,989
point getting to sort of something we

88
00:03:42,460 --> 00:03:37,850

would we would recognize as a modern

89
00:03:45,460 --> 00:03:42,470
life point so or just like another thing

90
00:03:48,819 --> 00:03:45,470
biologists can do is extra charge

91
00:03:51,100 --> 00:03:48,829
through analog studies and so right here

92
00:03:52,750 --> 00:03:51,110
is just the earth and obviously we can

93
00:03:54,699 --> 00:03:52,760
think of this as environment their

94
00:03:57,370 --> 00:03:54,709
environments on earth that are analogs

95
00:03:59,350 --> 00:03:57,380
for other planets either in our solar

96
00:04:01,630 --> 00:03:59,360
system or even exoplanets things like

97
00:04:03,310 --> 00:04:01,640
that because of the geochemical that the

98
00:04:06,940 --> 00:04:03,320
atmospheric conditions in these

99
00:04:09,310 --> 00:04:06,950
environments they mimic us you know with

100
00:04:11,530 --> 00:04:09,320
something like your OPA or Mars this can

101
00:04:12,940 --> 00:04:11,540
also apply to organisms themselves so

102
00:04:15,699 --> 00:04:12,950
you can have an organism that because

103
00:04:18,520 --> 00:04:15,709
because of the metabolism metabolism it

104
00:04:19,630 --> 00:04:18,530
employs it is an analogue it might not

105
00:04:21,940 --> 00:04:19,640
necessarily live in an analog

106
00:04:24,850 --> 00:04:21,950
environment but it could be an analog

107
00:04:26,350 --> 00:04:24,860
for an organism we might see on another

108
00:04:29,080 --> 00:04:26,360
environment for instance perchlorate

109
00:04:31,540 --> 00:04:29,090
reducers might not all live in Mars

110
00:04:32,350 --> 00:04:31,550
analog environments but that might be a

111
00:04:33,820 --> 00:04:32,360
very interesting

112
00:04:37,659 --> 00:04:33,830
metabolism for something that would be

113
00:04:38,890 --> 00:04:37,669

living on Mars right now so Laura's

114
00:04:41,860 --> 00:04:38,900
gonna talk to us about analog

115
00:04:44,170 --> 00:04:41,870
environments and she's gonna she's gonna

116
00:04:46,929 --> 00:04:44,180
talk about the the Atacama Desert in the

117
00:04:48,730 --> 00:04:46,939
Andes and you can just see basically you

118
00:04:51,249 --> 00:04:48,740
know the picture you know this is Earth

119
00:04:53,020 --> 00:04:51,259
Mars obviously but you know very similar

120
00:04:54,700 --> 00:04:53,030
and so what we do in these analog

121
00:04:55,749 --> 00:04:54,710
environments is basically go in and we

122
00:04:57,969 --> 00:04:55,759
look at who's there and what they're

123
00:04:58,719 --> 00:04:57,979
doing so we look first look at who's

124
00:05:01,149 --> 00:04:58,729
there

125
00:05:04,629 --> 00:05:01,159
and then probably more importantly how

126
00:05:06,790 --> 00:05:04,639
are they making their living there how

127
00:05:09,550 --> 00:05:06,800
are they utilizing what's there to to to

128
00:05:14,529 --> 00:05:09,560
grow to make to make necessary molecules

129
00:05:16,570 --> 00:05:14,539
and divide so those two and then another

130
00:05:18,550 --> 00:05:16,580
one that maybe even as thought of but

131
00:05:20,950 --> 00:05:18,560
that Larry do Lucas really introduced

132
00:05:23,110 --> 00:05:20,960
very well is that the biological effects

133
00:05:25,330 --> 00:05:23,120
of spaceflight in the space like our

134
00:05:27,850 --> 00:05:25,340
space environment so something like in a

135
00:05:30,339 --> 00:05:27,860
microgravity environment how that

136
00:05:33,129 --> 00:05:30,349
affects organisms all the way up from

137
00:05:33,909 --> 00:05:33,139
humans down to down to bacteria and so

138
00:05:36,510 --> 00:05:33,919

that's a really interesting question

139
00:05:39,850 --> 00:05:36,520
because this is an environment that

140
00:05:42,329 --> 00:05:39,860
nature and evolution have never seen and

141
00:05:45,010 --> 00:05:42,339
have never had to plank plan for so so

142
00:05:46,119 --> 00:05:45,020
understanding you know how how it adapts

143
00:05:49,149 --> 00:05:46,129
to this environment or what changes

144
00:05:52,420 --> 00:05:49,159
happen a very interesting question

145
00:05:55,659 --> 00:05:52,430
so Michaels gonna talk to us about that

146
00:05:58,930 --> 00:05:55,669
with this model gram positive bacteria

147
00:06:00,760 --> 00:05:58,940
organism called bacillus subtlest and

148
00:06:02,860 --> 00:06:00,770
he's basically just gonna look at gene

149
00:06:05,170 --> 00:06:02,870
expression comparing that to you know

150
00:06:07,719 --> 00:06:05,180
let's say you know we have a cell with

151
00:06:09,790 --> 00:06:07,729
where gene Y is turned on and gene Z is

152
00:06:11,499 --> 00:06:09,800
is turned off on earth but then we put

153
00:06:13,749 --> 00:06:11,509
it up in the international space system

154
00:06:15,279 --> 00:06:13,759
and then under all conditions being the

155
00:06:18,100 --> 00:06:15,289
same except for the fact that it's now

156
00:06:20,379 --> 00:06:18,110
in space well gy is turned off and gene

157
00:06:25,689 --> 00:06:20,389
Z is now turned on and so so what why

158
00:06:27,070 --> 00:06:25,699
does that happen so then finally it sort

159
00:06:29,050 --> 00:06:27,080
of goes along with this third goal point

160
00:06:32,260 --> 00:06:29,060
we have planetary protection human

161
00:06:33,999 --> 00:06:32,270
colonization of planetary bodies so

162
00:06:35,499 --> 00:06:34,009
there's a reason NASA spent all this

163
00:06:37,170 --> 00:06:35,509

money to make these things that they're

164
00:06:39,399 --> 00:06:37,180
sending out into the out into space

165
00:06:41,800 --> 00:06:39,409
extremely sterile extremely abiotic

166
00:06:44,110 --> 00:06:41,810
that's because we're very worried about

167
00:06:45,240 --> 00:06:44,120
bringing things like microorganisms from

168
00:06:46,950 --> 00:06:45,250
Earth and landing

169
00:06:49,350 --> 00:06:46,960
on an environment March where they might

170
00:06:50,750 --> 00:06:49,360
be able to grow and and now we have

171
00:06:54,900 --> 00:06:50,760
basically compromised

172
00:06:57,380 --> 00:06:54,910
the planet by bringing earth earthbound

173
00:07:00,390 --> 00:06:57,390
bacteria to that and so there's a lot of

174
00:07:01,950 --> 00:07:00,400
research looking at how basically we can

175
00:07:05,940 --> 00:07:01,960
keep from messing up the planet but all

176
00:07:07,830 --> 00:07:05,950
then also how we can while trying to not

177
00:07:11,340 --> 00:07:07,840
do that you know form settlements or

178
00:07:13,740 --> 00:07:11,350
stable colonies on these planets both

179
00:07:16,160 --> 00:07:13,750
sort of self-contained ones on places

180
00:07:18,720 --> 00:07:16,170
like the Moon or Mars and then also

181
00:07:20,700 --> 00:07:18,730
possibly on planets that have might have

182
00:07:25,100 --> 00:07:20,710
atmospheres that are conducive to human

183
00:07:28,200 --> 00:07:25,110
life open settlements and I don't think

184
00:07:30,510 --> 00:07:28,210
we're gonna make it today for this talk

185
00:07:32,280 --> 00:07:30,520
but she was going to give this really

186
00:07:35,550 --> 00:07:32,290
interesting talk about basically looking

187
00:07:36,810 --> 00:07:35,560
at how people aren't humans on earth

188
00:07:38,850 --> 00:07:36,820

through time have affected their

189
00:07:40,260 --> 00:07:38,860
environment both closed systems natural

190
00:07:42,420 --> 00:07:40,270
systems that aren't affected aren't as

191
00:07:44,190 --> 00:07:42,430
affected by humans and then other open

192
00:07:46,260 --> 00:07:44,200
systems and really what that means for

193
00:07:49,310 --> 00:07:46,270
our ability to basically sustain

194
00:07:52,140 --> 00:07:49,320
something like a some type of dome on

195
00:07:54,990 --> 00:07:52,150
colony on earth or on the Moon or Mars

196
00:07:57,450 --> 00:07:55,000
but also some type of actual new

197
00:07:58,980 --> 00:07:57,460
settlement uncontained settlement on an

198
00:08:01,890 --> 00:07:58,990
exoplanet that might have a an

199
00:08:07,290 --> 00:08:01,900
atmosphere an eco sphere similar to

200
00:08:09,030 --> 00:08:07,300
Earth so with that I just like to invite

201
00:08:10,680 --> 00:08:09,040
you to sit back relax and enjoy what I'm

202
00:08:15,110 --> 00:08:10,690
sure will be some fascinating and very