
AB
GRAD
CON23

1
00:00:04,230 --> 00:00:10,930
[Music]

2
00:00:14,990 --> 00:00:12,890
all right hello everyone my name is

3
00:00:16,910 --> 00:00:15,000
Jordan mckaig and I am a PhD candidate

4
00:00:18,529 --> 00:00:16,920
at Georgia Tech I'm working with Dr

5
00:00:20,990 --> 00:00:18,539
Chris Carr on using solid state

6
00:00:22,670 --> 00:00:21,000
nanopores to detect biosignatures and

7
00:00:24,050 --> 00:00:22,680
think about potential for agnostic life

8
00:00:25,730 --> 00:00:24,060
detection

9
00:00:26,929 --> 00:00:25,740
so throughout our universe or throughout

10
00:00:28,849 --> 00:00:26,939
our solar system rather there are a

11
00:00:30,529 --> 00:00:28,859
variety of planetary bodies that have

12
00:00:32,330 --> 00:00:30,539
conditions thought to be hospitable for

13
00:00:34,010 --> 00:00:32,340

life so things that are in the middle of

14
00:00:36,770 --> 00:00:34,020
this fine diagram containing the right

15
00:00:38,630 --> 00:00:36,780
raw materials energy sources solvents

16
00:00:40,790 --> 00:00:38,640
and climate conditions for living things

17
00:00:42,470 --> 00:00:40,800
to possibly persist many of these

18
00:00:43,850 --> 00:00:42,480
environments are aqueous and saline

19
00:00:46,369 --> 00:00:43,860
environments and as we've discussed

20
00:00:48,110 --> 00:00:46,379
previously today and yesterday salts

21
00:00:50,090 --> 00:00:48,120
have a major influence on the ability of

22
00:00:52,250 --> 00:00:50,100
an organism to live in an environment as

23
00:00:54,290 --> 00:00:52,260
well as the potential for Bio signature

24
00:00:56,029 --> 00:00:54,300
um excuse me sorry biosignature

25
00:00:58,790 --> 00:00:56,039
preservation and I'm particularly

26
00:01:00,470 --> 00:00:58,800
interested in how salts can interact

27
00:01:02,750 --> 00:01:00,480
with these biomolecules in terms of

28
00:01:04,850 --> 00:01:02,760
doing detection with nanopores

29
00:01:06,590 --> 00:01:04,860
so specifically the biosignatures that

30
00:01:08,990 --> 00:01:06,600
I'm interested in are nucleic acids and

31
00:01:11,390 --> 00:01:09,000
ribosomes nucleic acids that's your DNA

32
00:01:13,070 --> 00:01:11,400
and RNA it's a linear charge polymer

33
00:01:15,710 --> 00:01:13,080
that is responsible for storing and

34
00:01:17,450 --> 00:01:15,720
regulating genetic information ribosomes

35
00:01:20,270 --> 00:01:17,460
are cellular Machinery that translate

36
00:01:21,050 --> 00:01:20,280
this information into usable proteins

37
00:01:22,429 --> 00:01:21,060
um

38
00:01:24,410 --> 00:01:22,439

oh sorry

39
00:01:26,390 --> 00:01:24,420
excuse me um nucleic acids and ribosomes

40
00:01:28,190 --> 00:01:26,400
are ubiquitous to all known life and are

41
00:01:30,230 --> 00:01:28,200
part of the central dogma of biology so

42
00:01:32,090 --> 00:01:30,240
this is a paradigm in biology that

43
00:01:34,490 --> 00:01:32,100
traces the flow of information from

44
00:01:37,069 --> 00:01:34,500
these charged Polymers of DNA and RNA um

45
00:01:39,170 --> 00:01:37,079
through proteins

46
00:01:40,609 --> 00:01:39,180
so it's been proposed that molecules of

47
00:01:42,050 --> 00:01:40,619
similar structure and function but

48
00:01:43,310 --> 00:01:42,060
different biochemistry from some of

49
00:01:45,770 --> 00:01:43,320
these things could actually serve as

50
00:01:47,630 --> 00:01:45,780
evidence for life as we don't know it

51
00:01:49,429 --> 00:01:47,640
um in 2017 it was proposed that linear

52
00:01:51,770 --> 00:01:49,439
charged polymers with repeating units

53
00:01:53,870 --> 00:01:51,780
analogous to nucleic acids like DNA and

54
00:01:55,609 --> 00:01:53,880
RNA could serve as an agnostic bat

55
00:01:57,109 --> 00:01:55,619
signature and we are also working on a

56
00:01:59,149 --> 00:01:57,119
paper arguing that translation

57
00:02:01,249 --> 00:01:59,159
performing molecules of a quantized size

58
00:02:03,109 --> 00:02:01,259
analogous ribosomes could similarly

59
00:02:04,670 --> 00:02:03,119
serve this function since these don't

60
00:02:05,929 --> 00:02:04,680
have the same biochemistry of Life as we

61
00:02:07,490 --> 00:02:05,939
know it here on Earth it would require

62
00:02:09,109 --> 00:02:07,500
detection with a method that doesn't

63
00:02:11,270 --> 00:02:09,119

necessitate any specific chemical

64
00:02:14,809 --> 00:02:11,280
composition which leads us to solid

65
00:02:17,990 --> 00:02:14,819
state nanopores this is an agnostic mode

66
00:02:19,610 --> 00:02:18,000
of detection which requires a molecule

67
00:02:22,369 --> 00:02:19,620
to be suspended in a conductive solution

68
00:02:23,630 --> 00:02:22,379
so your nanopore here is a nanometer

69
00:02:25,790 --> 00:02:23,640
scale pore that's drilled into a

70
00:02:27,350 --> 00:02:25,800
membrane a current is passed over it and

71
00:02:29,750 --> 00:02:27,360
a voltage or a pressure differential

72
00:02:30,890 --> 00:02:29,760
drives molecules through the pore as

73
00:02:32,449 --> 00:02:30,900
things go through on these

74
00:02:33,650 --> 00:02:32,459
translocations create blockages and

75
00:02:35,809 --> 00:02:33,660
current which can be used to get

76
00:02:37,490 --> 00:02:35,819
information about the biomolecules

77
00:02:38,930 --> 00:02:37,500
and I just want to highlight again this

78
00:02:40,369 --> 00:02:38,940
does not require specific biochemistry

79
00:02:41,750 --> 00:02:40,379
making it exciting for not only

80
00:02:43,130 --> 00:02:41,760
investigating living things here on

81
00:02:44,449 --> 00:02:43,140
Earth but also potentially elsewhere in

82
00:02:46,430 --> 00:02:44,459
the solar system

83
00:02:48,530 --> 00:02:46,440
so what we did was show a proof of

84
00:02:50,990 --> 00:02:48,540
concept for something called the Ontario

85
00:02:53,030 --> 00:02:51,000
Nano counter which was a proprietary um

86
00:02:54,350 --> 00:02:53,040
solid state nanoportion shreds and these

87
00:02:56,210 --> 00:02:54,360
are all the different biomolecules that

88
00:02:58,670 --> 00:02:56,220

we analyze including some DNA samples

89
00:03:00,890 --> 00:02:58,680
RNA and ribosomes and if you'd like to

90
00:03:02,150 --> 00:03:00,900
hear more details about how specifically

91
00:03:03,350 --> 00:03:02,160
this went down please come talk to me at

92
00:03:06,410 --> 00:03:03,360
my poster

93
00:03:10,190 --> 00:03:06,420
and then also I have some of the example

94
00:03:11,690 --> 00:03:10,200
um results so first we have a few graphs

95
00:03:13,850 --> 00:03:11,700
showing just different example events

96
00:03:16,250 --> 00:03:13,860
with signature specific events for each

97
00:03:17,750 --> 00:03:16,260
biomolecule structure and then some heat

98
00:03:19,550 --> 00:03:17,760
maps showing the change in conductance

99
00:03:21,589 --> 00:03:19,560
in the dwell time for all the events in

100
00:03:23,449 --> 00:03:21,599
a specific run and then some overlaid

101
00:03:25,490 --> 00:03:23,459
samples of what all these events looked

102
00:03:27,949 --> 00:03:25,500
like and what I just want to highlight

103
00:03:29,390 --> 00:03:27,959
here is let's see do I have

104
00:03:32,210 --> 00:03:29,400
okay great

105
00:03:34,550 --> 00:03:32,220
um I have overlay DNA events all here in

106
00:03:36,830 --> 00:03:34,560
the blue this is a circular plasmid um

107
00:03:38,809 --> 00:03:36,840
so it's just a circular piece of DNA and

108
00:03:40,550 --> 00:03:38,819
it is a pretty short dwell time but also

109
00:03:41,570 --> 00:03:40,560
a much larger change in current and this

110
00:03:43,910 --> 00:03:41,580
is probably due to the circular

111
00:03:45,890 --> 00:03:43,920
structure instead of a linear polymer

112
00:03:47,449 --> 00:03:45,900
um so when you have a circular piece of

113
00:03:49,789 --> 00:03:47,459

DNA going through the nanopore you would

114
00:03:51,410 --> 00:03:49,799
have four strands of DNA instead of the

115
00:03:53,809 --> 00:03:51,420
two strands that's in a regular linear

116
00:03:55,490 --> 00:03:53,819
fragment similarly for linear fragments

117
00:03:57,470 --> 00:03:55,500
we have these two right here with this

118
00:03:58,850 --> 00:03:57,480
one in red being a shorter fragment and

119
00:04:00,949 --> 00:03:58,860
the one in black being a longer fragment

120
00:04:02,030 --> 00:04:00,959
which is reflected in that longer dwell

121
00:04:04,070 --> 00:04:02,040
time

122
00:04:06,050 --> 00:04:04,080
then I also have the data for the

123
00:04:08,750 --> 00:04:06,060
ribosomal detection so there are a few

124
00:04:10,610 --> 00:04:08,760
key classes of results here the ones in

125
00:04:13,490 --> 00:04:10,620
box a we interpreted as being intact

126
00:04:14,809 --> 00:04:13,500
ribosomes since they're larger and um

127
00:04:15,949 --> 00:04:14,819
than things in box B would have been

128
00:04:18,050 --> 00:04:15,959
smaller particles which we actually

129
00:04:19,310 --> 00:04:18,060
think were ribosomal fragments so we

130
00:04:20,390 --> 00:04:19,320
thought that maybe we had some issues

131
00:04:23,330 --> 00:04:20,400
with the buffer causing that

132
00:04:25,550 --> 00:04:23,340
precipitation which allows us not only

133
00:04:27,350 --> 00:04:25,560
um analyze the exact intact ribosomes as

134
00:04:28,490 --> 00:04:27,360
well as fragments themselves so if you'd

135
00:04:30,350 --> 00:04:28,500
like to hear more please come talk to me

136
00:04:31,969 --> 00:04:30,360
at my poster I'll be at number 19 which

137
00:04:32,720 --> 00:04:31,979
is um kind of over by the window thank

138
00:04:36,500 --> 00:04:32,730

you all

139
00:04:37,070 --> 00:04:36,510
[Applause]

140
00:04:39,050 --> 00:04:37,080
[Music]

141
00:04:46,150 --> 00:04:39,060
[Applause]

142
00:04:47,850 --> 00:04:46,160
[Music]