



Society for Scientific Exploration

1
00:00:13,190 --> 00:00:10,970
I have had many requests I have brought

2
00:00:15,829 --> 00:00:13,200
my family before to pass SSC meetings

3
00:00:18,050 --> 00:00:15,839
and I have had no doubt I would say

4
00:00:20,810 --> 00:00:18,060
about two dozen requests from people

5
00:00:23,870 --> 00:00:20,820
asking me where's my wife where are my

6
00:00:25,400 --> 00:00:23,880
kids and so I got on the phone I called

7
00:00:27,050 --> 00:00:25,410
up my wife and I said I think you're

8
00:00:28,939 --> 00:00:27,060
gonna need to send a picture she goes

9
00:00:30,589 --> 00:00:28,949
I'll send the beach picture I said okay

10
00:00:34,280 --> 00:00:30,599
that'll be fine I'll put it at the front

11
00:00:36,440 --> 00:00:34,290
so therefore here they are there's my

12
00:00:38,780 --> 00:00:36,450
son Gregory five years old in the middle

13
00:00:41,360 --> 00:00:38,790

hiding there's Benedict being held by my

14

00:00:43,639 --> 00:00:41,370

wife Karen and there's Lydia at one and

15

00:00:45,350 --> 00:00:43,649

a half room I'm holding right there this

16

00:00:46,639 --> 00:00:45,360

is I am from Florida for those of you

17

00:00:48,290 --> 00:00:46,649

are not aware so this is at the beach

18

00:00:51,529 --> 00:00:48,300

and for those of you who are from

19

00:00:55,970 --> 00:00:51,539

Colorado this is called an ocean behind

20

00:00:57,799 --> 00:00:55,980

me it's a big body of water so we've got

21

00:01:01,310 --> 00:00:57,809

lots of beaches there and so I just

22

00:01:03,709 --> 00:01:01,320

wanted to share that with you as at the

23

00:01:05,990 --> 00:01:03,719

beginning of the talk now let's see

24

00:01:08,240 --> 00:01:06,000

which one there we go

25

00:01:11,510 --> 00:01:08,250

the talk challenging the insect

26

00:01:13,100 --> 00:01:11,520

olfaction paradigm new evidence some of

27

00:01:14,420 --> 00:01:13,110

you probably knew that I was going to be

28

00:01:16,730 --> 00:01:14,430

talking about insect old-fashioned this

29

00:01:18,560 --> 00:01:16,740

is specifically what we study more so

30

00:01:21,050 --> 00:01:18,570

than anything else at the laboratory

31

00:01:22,999 --> 00:01:21,060

although we do study other parts of bio

32

00:01:25,160 --> 00:01:23,009

electromagnetics but having the

33

00:01:26,570 --> 00:01:25,170

background in entomology this has really

34

00:01:29,359 --> 00:01:26,580

forced me in order to go after the

35

00:01:30,770 --> 00:01:29,369

insects more so and it was a number of

36

00:01:32,630 --> 00:01:30,780

years ago that I realized that there

37

00:01:34,760 --> 00:01:32,640

were problems as many of us have found

38

00:01:37,069 --> 00:01:34,770

uncertain paradigms in the insect

39

00:01:40,370 --> 00:01:37,079

olfaction paradigm was one of them now I

40

00:01:42,740 --> 00:01:40,380

did present in 2009 and in 2009 I talked

41

00:01:44,240 --> 00:01:42,750

about the temporal evidence against the

42

00:01:46,880 --> 00:01:44,250

current theory of insect olfaction

43

00:01:49,130 --> 00:01:46,890

however now three years later there are

44

00:01:51,679 --> 00:01:49,140

some new evidence to report therefore

45

00:01:54,230 --> 00:01:51,689

I'm going to first introduce what the

46

00:01:56,450 --> 00:01:54,240

insect olfaction paradigm is so that all

47

00:01:57,530 --> 00:01:56,460

of you are all up on the same boat and

48

00:01:59,929 --> 00:01:57,540

you're understanding where I'm coming

49

00:02:02,030 --> 00:01:59,939

from and then I'm going to introduce the

50

00:02:05,149 --> 00:02:02,040

new evidence that you can see and follow

51
00:02:08,559 --> 00:02:05,159
along why I have some difficulties with

52
00:02:10,639 --> 00:02:08,569
that with that particular paradigm

53
00:02:12,110 --> 00:02:10,649
olfaction and insects how is it

54
00:02:14,059 --> 00:02:12,120
accomplished most of us know that

55
00:02:17,390 --> 00:02:14,069
insects smell what they're

56
00:02:19,910 --> 00:02:17,400
we do not know that instinctively so

57
00:02:22,099 --> 00:02:19,920
we've got a large by pectin ADA antenna

58
00:02:24,110 --> 00:02:22,109
from the Saturn eyed moth off to the

59
00:02:25,550 --> 00:02:24,120
left we have another clear wing to moth

60
00:02:28,339 --> 00:02:25,560
off to the right but you can see the

61
00:02:30,259 --> 00:02:28,349
antennae are very prominent and that is

62
00:02:32,330 --> 00:02:30,269
how almost all insects smelled I know

63
00:02:34,280 --> 00:02:32,340

there's some smelling and tasting on the

64

00:02:36,890 --> 00:02:34,290

feet and the wings and even on the back

65

00:02:39,170 --> 00:02:36,900

end of the insect but for the most part

66

00:02:41,990 --> 00:02:39,180

odorants are picked up by the antenna

67

00:02:43,849 --> 00:02:42,000

now if we zoom in on the antenna we can

68

00:02:45,589 --> 00:02:43,859

see that there are some small structures

69

00:02:47,960 --> 00:02:45,599

and I want to point those out because

70

00:02:50,509 --> 00:02:47,970

it's not the antenna proper that is

71

00:02:54,759 --> 00:02:50,519

necessarily involved in insect olfaction

72

00:02:57,140 --> 00:02:54,769

we have these very tiny sencilla

73

00:02:58,759 --> 00:02:57,150

sometimes called hairs sometimes they're

74

00:03:01,309 --> 00:02:58,769

called tricloid scintilla which means a

75

00:03:04,399 --> 00:03:01,319

hair sencilla and these are the actual

76

00:03:06,050 --> 00:03:04,409

structures which are involved in insect

77

00:03:09,530 --> 00:03:06,060

old-fashion this is what they're

78

00:03:12,080 --> 00:03:09,540

actually using to detect the odorants in

79

00:03:14,420 --> 00:03:12,090

some case a pheromone so I've zoomed in

80

00:03:16,009 --> 00:03:14,430

on one just one of these hairs and these

81

00:03:18,229 --> 00:03:16,019

things are microscopic you can't seem

82

00:03:19,939 --> 00:03:18,239

with the naked eye but if we zoom in on

83

00:03:21,770 --> 00:03:19,949

this we see this is these are the cells

84

00:03:24,140 --> 00:03:21,780

underneath there's a truck gent or Majin

85

00:03:26,059 --> 00:03:24,150

selfie kijun cell three cells that are

86

00:03:27,920 --> 00:03:26,069

involved in the formation of the hair

87

00:03:30,229 --> 00:03:27,930

and the socket up above we have

88

00:03:31,699 --> 00:03:30,239

something sticking up above the cuticle

89

00:03:33,979 --> 00:03:31,709

which is the hair light portion that you

90

00:03:37,039 --> 00:03:33,989

see right there there are some holes in

91

00:03:38,990 --> 00:03:37,049

the top these pores are very tiny some

92

00:03:42,050 --> 00:03:39,000

are on the order of 10 to 15 nanometers

93

00:03:43,789 --> 00:03:42,060

can't see those either and the pheromone

94

00:03:45,789 --> 00:03:43,799

in these case the long-chain carbon

95

00:03:47,809 --> 00:03:45,799

molecules which is indicative of most

96

00:03:49,699 --> 00:03:47,819

lepidopteran pheromones those being the

97

00:03:51,800 --> 00:03:49,709

butterflies and the moss would then

98

00:03:54,439 --> 00:03:51,810

enter the holes and make their way

99

00:03:57,229 --> 00:03:54,449

through this watery matrix right here

100

00:03:59,539 --> 00:03:57,239

and actually impinge upon a dendrite so

101
00:04:01,610 --> 00:03:59,549
there's a dendrite extending up into the

102
00:04:05,869 --> 00:04:01,620
hair right there which is the final

103
00:04:07,129 --> 00:04:05,879
detector of the insect pheromone what

104
00:04:10,069 --> 00:04:07,139
I'm going to do is I'm going to zoom in

105
00:04:11,990 --> 00:04:10,079
right now so I'm zooming in adjust this

106
00:04:13,849 --> 00:04:12,000
part so I don't want to talk about the

107
00:04:17,420 --> 00:04:13,859
entire hair but I do want to focus on

108
00:04:20,390 --> 00:04:17,430
the pores the outside cuticle and the

109
00:04:22,310 --> 00:04:20,400
dendrites on the inside let's continue

110
00:04:24,140 --> 00:04:22,320
this is now the close-up that I just

111
00:04:27,530 --> 00:04:24,150
described to you with that red

112
00:04:30,290 --> 00:04:27,540
rectangular box now we can see the

113
00:04:32,060 --> 00:04:30,300

said cuticle those blue dots are what

114

00:04:33,950 --> 00:04:32,070

I'm going to call the pheromone these

115

00:04:35,840 --> 00:04:33,960

yellow dots of the pheromone degrading

116

00:04:37,640 --> 00:04:35,850

enzymes they eat up the pheromone first

117

00:04:39,170 --> 00:04:37,650

chance they get they're very good at and

118

00:04:41,060 --> 00:04:39,180

they fart are found on the outside in

119

00:04:42,620 --> 00:04:41,070

addition they're also found on the

120

00:04:44,270 --> 00:04:42,630

inside so any pheromone that's going to

121

00:04:46,100 --> 00:04:44,280

get inside is also going to get picked

122

00:04:48,410 --> 00:04:46,110

off by the pheromone degrading enzymes

123

00:04:50,210 --> 00:04:48,420

and they're working very very hard in

124

00:04:54,950 --> 00:04:50,220

order to eat the pheromone as quickly as

125

00:04:57,200 --> 00:04:54,960

possible now what happens is because the

126

00:05:00,230 --> 00:04:57,210

pheromone cannot cross this watery

127

00:05:03,620 --> 00:05:00,240

matrix because it is a long-chain fatty

128

00:05:05,930 --> 00:05:03,630

acid oil and water don't mix therefore

129

00:05:07,760 --> 00:05:05,940

it has to pick off a ride from another

130

00:05:10,310 --> 00:05:07,770

molecule this other molecule is called a

131

00:05:13,520 --> 00:05:10,320

binding protein this binding protein

132

00:05:16,910 --> 00:05:13,530

picks up the pheromone at the pore just

133

00:05:19,970 --> 00:05:16,920

like that it travels the cross via

134

00:05:21,560 --> 00:05:19,980

diffusion makes its way to the dimer

135

00:05:24,170 --> 00:05:21,570

receptor we actually know that the

136

00:05:27,440 --> 00:05:24,180

receptor is composed of two proteins not

137

00:05:30,740 --> 00:05:27,450

just one and this dimer receptor then

138

00:05:34,610 --> 00:05:30,750

somehow is able to pick and recognize

139

00:05:37,580 --> 00:05:34,620

the pheromone or the pheromone pheromone

140

00:05:39,280 --> 00:05:37,590

binding protein complex it is not quite

141

00:05:41,750 --> 00:05:39,290

clear whether or not there is a

142

00:05:44,330 --> 00:05:41,760

separation of the pheromone or whether

143

00:05:46,340 --> 00:05:44,340

or not they actually are detected in the

144

00:05:49,760 --> 00:05:46,350

complex and this separation if it does

145

00:05:51,830 --> 00:05:49,770

occur occurs at a pH of five otherwise

146

00:05:53,570 --> 00:05:51,840

there will be no breaking of the bond

147

00:05:56,720 --> 00:05:53,580

between the binding protein and the

148

00:05:59,270 --> 00:05:56,730

pheromone so it's to show you what the

149

00:06:00,860 --> 00:05:59,280

relative sizes of the binding protein

150

00:06:02,810 --> 00:06:00,870

versus the pheromone the binding protein

151
00:06:05,510 --> 00:06:02,820
is much bigger it's about sixty six

152
00:06:07,700 --> 00:06:05,520
times bigger assuming a volumetric mass

153
00:06:09,830 --> 00:06:07,710
of a sphere and they're not spheres I

154
00:06:12,080 --> 00:06:09,840
understand that that the pheromone

155
00:06:14,120 --> 00:06:12,090
binding protein is roughly globular the

156
00:06:17,690 --> 00:06:14,130
pheromone is not usually circular but I

157
00:06:19,850 --> 00:06:17,700
actually drew this to scale so that you

158
00:06:21,020 --> 00:06:19,860
can see the size difference between them

159
00:06:23,150 --> 00:06:21,030
and that if the pheromone does not

160
00:06:25,040 --> 00:06:23,160
escape remember that part of it is going

161
00:06:27,530 --> 00:06:25,050
to be bound to the binding protein and

162
00:06:30,110 --> 00:06:27,540
it will not be able to be necessarily

163
00:06:32,780 --> 00:06:30,120

detected so we've got a dilemma right

164

00:06:35,030 --> 00:06:32,790

here is the pheromone alone being

165

00:06:37,010 --> 00:06:35,040

detected at the dendritic membrane or is

166

00:06:39,350 --> 00:06:37,020

the pheromone pheromone binding protein

167

00:06:41,570 --> 00:06:39,360

complex in other words it doesn't break

168

00:06:42,830 --> 00:06:41,580

up there are two fields of thought

169

00:06:44,330 --> 00:06:42,840

I know a number of American researchers

170

00:06:45,740 --> 00:06:44,340

that feel the first I've talked to

171

00:06:49,159 --> 00:06:45,750

German researchers who believe in the

172

00:06:51,409 --> 00:06:49,169

second but if the receptor detects the

173

00:06:53,689 --> 00:06:51,419

pheromone shape then obviously the

174

00:06:55,189 --> 00:06:53,699

pheromone alone needs to do that however

175

00:06:56,360 --> 00:06:55,199

we have a different situation if the

176

00:07:00,619 --> 00:06:56,370

Germans are correct

177

00:07:02,929 --> 00:07:00,629

complex then binds with it the receptor

178

00:07:11,839 --> 00:07:02,939

detects the whole complex and identifies

179

00:07:13,939 --> 00:07:11,849

the pheromone based on this complex this

180

00:07:16,309 --> 00:07:13,949

is the summary slide that I gave back in

181

00:07:17,510 --> 00:07:16,319

2009 I wanted to jog your memory for

182

00:07:21,770 --> 00:07:17,520

those of you who were there with me in

183

00:07:25,240 --> 00:07:21,780

2009 I had expressed that the temporal

184

00:07:29,119 --> 00:07:25,250

evidence did did show that it's actually

185

00:07:31,999 --> 00:07:29,129

impossible for the pheromone or any

186

00:07:35,959 --> 00:07:32,009

odorant in order to reach the dendritic

187

00:07:38,480 --> 00:07:35,969

membrane in time in order to explain

188

00:07:40,490 --> 00:07:38,490

insect olfaction time to adhere to the

189

00:07:42,890 --> 00:07:40,500

sencilla zero milliseconds time to

190

00:07:44,959 --> 00:07:42,900

diffuse through the wax later takes

191

00:07:47,149 --> 00:07:44,969

between minutes and hours time to

192

00:07:49,070 --> 00:07:47,159

diffuse through the pores nothing's been

193

00:07:50,779 --> 00:07:49,080

published it's unknown time to actually

194

00:07:52,969 --> 00:07:50,789

bind the pheromone only about one

195

00:07:55,670 --> 00:07:52,979

millisecond time to transport the

196

00:07:58,070 --> 00:07:55,680

pheromone only if it's a perfect watery

197

00:07:59,269 --> 00:07:58,080

matrix diffusion laws say that it's

198

00:08:01,879 --> 00:07:59,279

going to take a minimum of 12

199

00:08:04,899 --> 00:08:01,889

milliseconds time to dissociate from the

200

00:08:08,360 --> 00:08:04,909

pheromone 9 milliseconds if a pH of 5

201
00:08:09,950 --> 00:08:08,370
100 seconds if we don't have that pH of

202
00:08:12,170 --> 00:08:09,960
5 and finally time to activate the

203
00:08:14,180 --> 00:08:12,180
receptor less than one millisecond it's

204
00:08:16,399 --> 00:08:14,190
actually on the order of Pico seconds so

205
00:08:18,589 --> 00:08:16,409
if you add this all up you can see that

206
00:08:20,480 --> 00:08:18,599
it's impossible to reach the goal of 1

207
00:08:22,850 --> 00:08:20,490
to 10 milliseconds why is it 1 to 10

208
00:08:25,670 --> 00:08:22,860
milliseconds because we know the insect

209
00:08:28,159 --> 00:08:25,680
can smell within about 1 to 10

210
00:08:30,589 --> 00:08:28,169
milliseconds so if you cannot explain

211
00:08:32,689 --> 00:08:30,599
how the pheromone gets there then how is

212
00:08:34,880 --> 00:08:32,699
detection occurring and we know very

213
00:08:38,750 --> 00:08:34,890

reliably that it's occurring in less

214

00:08:40,880 --> 00:08:38,760

than 10 milliseconds for your biologist

215

00:08:43,040 --> 00:08:40,890

I want to put this into perspective for

216

00:08:43,969 --> 00:08:43,050

your biologists or maybe neurobiologist

217

00:08:48,230 --> 00:08:43,979

I know there's a couple of you in the

218

00:08:49,519 --> 00:08:48,240

audience right now these synapse if we

219

00:08:52,100 --> 00:08:49,529

take a look at the time course of events

220

00:08:55,610 --> 00:08:52,110

of a neurotransmitter as it goes across

221

00:08:58,250 --> 00:08:55,620

the synapse it takes between 3.3 and

222

00:09:00,710 --> 00:08:58,260

five point three milliseconds for

223

00:09:02,900 --> 00:09:00,720

synaptic transmission to occur for the

224

00:09:05,140 --> 00:09:02,910

process of that to occur the insect

225

00:09:08,240 --> 00:09:05,150

pheromone is on the same order of

226

00:09:10,790 --> 00:09:08,250

detection on a timescale as a synapse

227

00:09:12,140 --> 00:09:10,800

the synapse and for your neurobiologist

228

00:09:14,870 --> 00:09:12,150

it would be a type two acetylcholine

229

00:09:18,140 --> 00:09:14,880

receptor the synapse is running about

230

00:09:20,030 --> 00:09:18,150

twenty nanometers the insects and Scylla

231

00:09:22,700 --> 00:09:20,040

the pheromone has to travel between

232

00:09:24,740 --> 00:09:22,710

eleven hundred and fifty to two thousand

233

00:09:27,710 --> 00:09:24,750

nanometers so there's a very big

234

00:09:30,170 --> 00:09:27,720

difference in space that needs to be

235

00:09:32,360 --> 00:09:30,180

traveled and therefore to assume that

236

00:09:35,829 --> 00:09:32,370

the synapse and thus in Scylla are

237

00:09:40,519 --> 00:09:35,839

smelling at the same time is hard

238

00:09:42,320 --> 00:09:40,529

scientifically to believe so what else

239

00:09:43,400 --> 00:09:42,330

is going on some of you know the

240

00:09:44,930 --> 00:09:43,410

direction that I'm heading into right

241

00:09:47,180 --> 00:09:44,940

now because obviously I'm involved in

242

00:09:48,740 --> 00:09:47,190

bio electro magnetics so is there a

243

00:09:51,769 --> 00:09:48,750

possibility that there is something else

244

00:09:54,079 --> 00:09:51,779

going on besides the classic diffusion

245

00:09:56,540 --> 00:09:54,089

lock-and-key method which has talked

246

00:09:58,700 --> 00:09:56,550

about in the textbooks and an insect

247

00:10:02,449 --> 00:09:58,710

physiology courses that are taught in

248

00:10:04,220 --> 00:10:02,459

departments of entomology so part of the

249

00:10:06,620 --> 00:10:04,230

research that is conducted our

250

00:10:08,630 --> 00:10:06,630

laboratory is in literature reviews this

251

00:10:10,670 --> 00:10:08,640

is a forgotten science in my opinion

252

00:10:12,380 --> 00:10:10,680

because many people feel that science is

253

00:10:14,390 --> 00:10:12,390

based upon producing tables and graphs

254

00:10:17,300 --> 00:10:14,400

and figures and and doing all that kind

255

00:10:18,470 --> 00:10:17,310

of stuff when in actuality canvassing

256

00:10:19,850 --> 00:10:18,480

the literature especially when you're

257

00:10:22,970 --> 00:10:19,860

trying to come up with a new theory of

258

00:10:26,140 --> 00:10:22,980

insect olfaction becomes necessary so in

259

00:10:31,550 --> 00:10:26,150

reviewing things I ran across the paper

260

00:10:34,640 --> 00:10:31,560

from Kyle from Germany in 1984 as well

261

00:10:38,570 --> 00:10:34,650

as white Asik and Leal Walter Lee ELLs

262

00:10:41,329 --> 00:10:38,580

at UC in Davis in 1999 and both of them

263

00:10:44,540 --> 00:10:41,339

found using three different cationic

264

00:10:46,130 --> 00:10:44,550

markers that there are fixed negative

265

00:10:47,600 --> 00:10:46,140

charges present on the dendritic

266

00:10:50,540 --> 00:10:47,610

membrane of the sencilla

267

00:10:53,600 --> 00:10:50,550

well this is a useful information to

268

00:10:56,000 --> 00:10:53,610

start if I have fixed negative charges

269

00:10:57,260 --> 00:10:56,010

that are unmoving they're fixed then I

270

00:10:59,060 --> 00:10:57,270

might be able to play around with this

271

00:11:01,010 --> 00:10:59,070

from an electromagnetic standpoint to

272

00:11:05,510 --> 00:11:01,020

see what's possible and what's

273

00:11:07,490 --> 00:11:05,520

impossible so when I saw this paper I

274

00:11:09,560 --> 00:11:07,500

actually had a flashback back to my

275

00:11:10,880 --> 00:11:09,570

senior year at Cornell University

276

00:11:13,190 --> 00:11:10,890

I'm not talking about some of the

277

00:11:15,770 --> 00:11:13,200

flashbacks that you may have when you go

278

00:11:18,110 --> 00:11:15,780

back to your senior year at whatever

279

00:11:19,940 --> 00:11:18,120

college you happen to attend but when I

280

00:11:22,720 --> 00:11:19,950

was at Cornell I did a senior project in

281

00:11:24,890 --> 00:11:22,730

an involved SDS page SDS page stands for

282

00:11:27,140 --> 00:11:24,900

sodium dodecyl sulfate polyacrylamide

283

00:11:29,410 --> 00:11:27,150

gel electrophoresis and what this

284

00:11:33,200 --> 00:11:29,420

process does is it separates proteins

285

00:11:35,120 --> 00:11:33,210

now it separates proteins by what what

286

00:11:36,560 --> 00:11:35,130

you do is you have the proteins the

287

00:11:38,060 --> 00:11:36,570

process of separating them I'm not going

288

00:11:40,640 --> 00:11:38,070

to go into but you then coat them with

289

00:11:41,930 --> 00:11:40,650

negative charges and the more negative

290

00:11:44,720 --> 00:11:41,940

charges they have on them the bigger

291

00:11:46,670 --> 00:11:44,730

than the the binding protein is and so

292

00:11:49,160 --> 00:11:46,680

that's the idea of how to separate them

293

00:11:51,380 --> 00:11:49,170

so what we do is we place the proteins

294

00:11:54,890 --> 00:11:51,390

into these little wells right here on

295

00:11:57,530 --> 00:11:54,900

the top and they then fall through once

296

00:11:59,510 --> 00:11:57,540

we create an electrical charge so we

297

00:12:01,250 --> 00:11:59,520

have a negative electrode at the top we

298

00:12:03,920 --> 00:12:01,260

have a positive electrode at the bottom

299

00:12:05,600 --> 00:12:03,930

they're coated with a negatively charged

300

00:12:07,610 --> 00:12:05,610

protein so they're going to be repelled

301
00:12:09,650 --> 00:12:07,620
by the negative electrode when we turn

302
00:12:10,940 --> 00:12:09,660
it on they're going to be attracted to

303
00:12:13,730 --> 00:12:10,950
the positive electrode and they will

304
00:12:15,500 --> 00:12:13,740
then move down in the straight direction

305
00:12:18,170 --> 00:12:15,510
and they will then create bands and

306
00:12:20,900 --> 00:12:18,180
these bands will separate the proteins

307
00:12:22,370 --> 00:12:20,910
according to charge but according to our

308
00:12:24,200 --> 00:12:22,380
understanding of it they're actually

309
00:12:26,680 --> 00:12:24,210
being separated according to size

310
00:12:29,030 --> 00:12:26,690
because that's what we're looking for so

311
00:12:31,400 --> 00:12:29,040
understanding how this process works and

312
00:12:32,720 --> 00:12:31,410
realizing the research that I just

313
00:12:34,220 --> 00:12:32,730

showed you before I thought there's

314

00:12:37,850 --> 00:12:34,230

something that we might be able to play

315

00:12:41,660 --> 00:12:37,860

with here if I've got fixed negative

316

00:12:43,220 --> 00:12:41,670

charges on the dendritic membrane hmmm

317

00:12:46,250 --> 00:12:43,230

and the current theory says that the

318

00:12:48,830 --> 00:12:46,260

binding protein gets to that and I just

319

00:12:51,230 --> 00:12:48,840

spent an entire presentation in 2009

320

00:12:52,460 --> 00:12:51,240

saying that there's no way using the

321

00:12:54,920 --> 00:12:52,470

laws of diffusion that it's going to

322

00:12:56,930 --> 00:12:54,930

make it in time could there be something

323

00:12:58,520 --> 00:12:56,940

else going on I've actually spent a lot

324

00:13:00,650 --> 00:12:58,530

of time trying to ask people is there

325

00:13:02,150 --> 00:13:00,660

something else that I'm missing so when

326

00:13:03,620 --> 00:13:02,160

this idea came to me I thought I'm gonna

327

00:13:05,630 --> 00:13:03,630

go with it right now because if I got a

328

00:13:08,080 --> 00:13:05,640

negatively charged membrane and I can

329

00:13:12,230 --> 00:13:08,090

show that the binding proteins are

330

00:13:14,900 --> 00:13:12,240

positive then I've now got electrostatic

331

00:13:16,640 --> 00:13:14,910

attraction occurring between the binding

332

00:13:18,830 --> 00:13:16,650

protein which we know has to get to the

333

00:13:20,270 --> 00:13:18,840

dendritic membrane whether it separates

334

00:13:21,800 --> 00:13:20,280

the pheromone or not it's not important

335

00:13:23,269 --> 00:13:21,810

I just need to get that binding protein

336

00:13:25,280 --> 00:13:23,279

to the dendritic

337

00:13:26,720 --> 00:13:25,290

brain with my fixed negative charges

338

00:13:29,749 --> 00:13:26,730

just like sds-page

339

00:13:33,530 --> 00:13:29,759

I may be golden how do I do that

340

00:13:35,509 --> 00:13:33,540

mm-hmm only analyzed amino acids or

341

00:13:37,129 --> 00:13:35,519

proteins I should say you're taking a

342

00:13:38,569 --> 00:13:37,139

look at 20 amino acids there's only 20

343

00:13:40,879 --> 00:13:38,579

amino acids that we need to worry about

344

00:13:44,360 --> 00:13:40,889

these 20 amino acids are listed here

345

00:13:47,059 --> 00:13:44,370

with their three-letter code as well as

346

00:13:48,470 --> 00:13:47,069

their single letter code and obviously

347

00:13:49,970 --> 00:13:48,480

this is a lot to analyze I don't want to

348

00:13:51,860 --> 00:13:49,980

analyze all these so what I'm gonna do

349

00:13:54,049 --> 00:13:51,870

is I'm just gonna analyze some of them I

350

00:13:56,360 --> 00:13:54,059

want to analyze the five that have a

351

00:13:58,009 --> 00:13:56,370

charge associated with them and it's

352

00:13:59,299 --> 00:13:58,019

those five then we're gonna focus on and

353

00:14:00,980 --> 00:13:59,309

just for the purposes of this

354

00:14:04,819 --> 00:14:00,990

presentation going to ignore the other

355

00:14:08,079 --> 00:14:04,829

15 so I've got those five aspartic acid

356

00:14:11,239 --> 00:14:08,089

glutamic acid both of them negative

357

00:14:14,960 --> 00:14:11,249

histidine arginine lysine all three of

358

00:14:17,030 --> 00:14:14,970

them positive now if you play the odds

359

00:14:19,160 --> 00:14:17,040

if you like to play in Vegas and you

360

00:14:21,650 --> 00:14:19,170

want to play the odds I'm looking to get

361

00:14:23,749 --> 00:14:21,660

positively binding proteins I've got

362

00:14:26,119 --> 00:14:23,759

three positives and two negatives

363

00:14:29,420 --> 00:14:26,129

assuming an equal distribution of the

364

00:14:31,040 --> 00:14:29,430

amino acids I mean this this is just a

365

00:14:32,900 --> 00:14:31,050

win-win situation so I could say all I

366

00:14:34,579 --> 00:14:32,910

got to do is add this up and I'm gonna

367

00:14:37,280 --> 00:14:34,589

be able to show that are positively

368

00:14:39,910 --> 00:14:37,290

charged binding proteins indeed might be

369

00:14:44,299 --> 00:14:39,920

attracted and therefore I could speed up

370

00:14:45,619 --> 00:14:44,309

unnaturally the process of diffusion so

371

00:14:47,360 --> 00:14:45,629

how do you do this you obtain the amino

372

00:14:50,480 --> 00:14:47,370

acid sequence for a given binding

373

00:14:52,220 --> 00:14:50,490

protein on the NCBI website next you

374

00:14:54,199 --> 00:14:52,230

plug in the amino acid sequence in order

375

00:14:55,790 --> 00:14:54,209

to determine the signal peptide all

376

00:14:57,139 --> 00:14:55,800

peptides when they're produced in the

377

00:14:59,420 --> 00:14:57,149

nuclear membrane have a little bit of

378

00:15:00,619 --> 00:14:59,430

extra stuff on them and after they pass

379

00:15:02,900 --> 00:15:00,629

out of the nuclear membrane before

380

00:15:06,079 --> 00:15:02,910

they're activated they're cleaved and

381

00:15:07,519 --> 00:15:06,089

that signal peptide is cleaved off so I

382

00:15:09,019 --> 00:15:07,529

wanted to determine what the signal

383

00:15:11,809 --> 00:15:09,029

peptide was so that I knew what the

384

00:15:14,419 --> 00:15:11,819

active form of the binding protein was

385

00:15:16,460 --> 00:15:14,429

then I needed to determine the number of

386

00:15:18,079 --> 00:15:16,470

each charged amino acid add up the

387

00:15:21,259 --> 00:15:18,089

number of positive and negative charges

388

00:15:23,150 --> 00:15:21,269

simple arithmetic and then finally

389

00:15:26,780 --> 00:15:23,160

calculate the net charge on the binding

390

00:15:28,309 --> 00:15:26,790

protein so let's start there I started

391

00:15:30,019 --> 00:15:28,319

analyzing binding proteins and there's a

392

00:15:31,369 --> 00:15:30,029

lot of them out there right now these

393

00:15:33,049 --> 00:15:31,379

are the pheromone binding protein

394

00:15:34,819 --> 00:15:33,059

charges on the Saturn I at Moss the

395

00:15:36,030 --> 00:15:34,829

Saturn eye and muscle those large big

396

00:15:38,879 --> 00:15:36,040

Maus deluna mas

397

00:15:40,620 --> 00:15:38,889

propia Polyphemus and everyone likes to

398

00:15:42,120 --> 00:15:40,630

study them so you take a look at the

399

00:15:44,069 --> 00:15:42,130

Polyphemus moth it's got a pheromone

400

00:15:45,930 --> 00:15:44,079

binding protein one pheromone binding

401
00:15:48,090 --> 00:15:45,940
protein two for animal binding protein

402
00:15:50,610 --> 00:15:48,100
three continue on down the various

403
00:15:52,559 --> 00:15:50,620
species of saturn iods and you could see

404
00:15:56,939 --> 00:15:52,569
that i'm in trouble right from the

405
00:15:59,519 --> 00:15:56,949
get-go as a matter of fact only three of

406
00:16:04,559 --> 00:15:59,529
the sixteen binding proteins on this

407
00:16:06,600 --> 00:16:04,569
slide are positively charged I'm gonna

408
00:16:08,610 --> 00:16:06,610
keep going I was like oh there's got to

409
00:16:10,410 --> 00:16:08,620
be something going on here so I keep

410
00:16:12,660 --> 00:16:10,420
looking I look at other Lepidoptera not

411
00:16:14,730 --> 00:16:12,670
the Saturn iets all the species listed

412
00:16:16,199 --> 00:16:14,740
there their various binding proteins and

413
00:16:18,629 --> 00:16:16,209

there are more than one associated with

414

00:16:21,540 --> 00:16:18,639

each one negative negative negative as a

415

00:16:25,139 --> 00:16:21,550

matter of fact I have only got 2 out of

416

00:16:28,370 --> 00:16:25,149

15 that are positively charged I'm very

417

00:16:30,689 --> 00:16:28,380

competitive so I keep going mmm I

418

00:16:32,189 --> 00:16:30,699

analyzed more on the Lepidoptera as a

419

00:16:34,259 --> 00:16:32,199

matter of fact we even had two forms of

420

00:16:36,540 --> 00:16:34,269

Manduca sexta pheromone binding protein

421

00:16:38,100 --> 00:16:36,550

2 I analyzed both and I said well one

422

00:16:42,809 --> 00:16:38,110

might be right I don't know both will be

423

00:16:45,389 --> 00:16:42,819

right analyze those as well and 1 out of

424

00:16:48,600 --> 00:16:45,399

16 was positively charged

425

00:16:51,000 --> 00:16:48,610

I continue to Lepidoptera I've got 1 out

426

00:16:52,889 --> 00:16:51,010

of 14 I think you can see where I'm

427

00:16:54,930 --> 00:16:52,899

going obviously the frustration is

428

00:16:57,990 --> 00:16:54,940

beginning and I feel that Nobel Prize

429

00:17:00,059 --> 00:16:58,000

just being pulled out of my hand so

430

00:17:01,920 --> 00:17:00,069

there is actually Austrian Ubel Alice

431

00:17:03,809 --> 00:17:01,930

has a number of strains as two strains

432

00:17:06,090 --> 00:17:03,819

associated with it different receptivity

433

00:17:07,559 --> 00:17:06,100

to two different pheromone

434

00:17:09,299 --> 00:17:07,569

concentrations so I analyzed both of

435

00:17:12,149 --> 00:17:09,309

them I was getting no help there either

436

00:17:14,220 --> 00:17:12,159

zero out of ten were positive I took a

437

00:17:17,010 --> 00:17:14,230

look at some more zero out of sixteen

438

00:17:19,049 --> 00:17:17,020

were positive then I moved on to the

439

00:17:23,730 --> 00:17:19,059

Hymenoptera which are the wasps bees and

440

00:17:25,079 --> 00:17:23,740

ants and so I was not only was I not

441

00:17:27,120 --> 00:17:25,089

getting the positives that I was looking

442

00:17:28,710 --> 00:17:27,130

for but when I moved to the Hymenoptera

443

00:17:32,070 --> 00:17:28,720

we started getting some high level

444

00:17:34,140 --> 00:17:32,080

negative 12 negative 14 negative we got

445

00:17:35,430 --> 00:17:34,150

negative double digits so you were no

446

00:17:39,149 --> 00:17:35,440

longer dealing what we had in the

447

00:17:42,960 --> 00:17:39,159

Lepidoptera 12 12 really highly charged

448

00:17:46,560 --> 00:17:42,970

negatively charged binding proteins the

449

00:17:48,990 --> 00:17:46,570

scarab beetles scarab beetles also had a

450

00:17:49,560 --> 00:17:49,000

pretty consistent high there was one at

451
00:17:55,610 --> 00:17:49,570
negative

452
00:17:57,900 --> 00:17:55,620
exception of this one which is at zero

453
00:17:59,760 --> 00:17:57,910
and we charged other groups I took a

454
00:18:02,340 --> 00:17:59,770
look at *Drosophila melanogaster* why not

455
00:18:03,690 --> 00:18:02,350
everyone else does and I had a little

456
00:18:05,100 --> 00:18:03,700
bit of confusion there because they

457
00:18:06,330 --> 00:18:05,110
don't know what the binding protein is

458
00:18:08,640 --> 00:18:06,340
because they really don't have a

459
00:18:12,539 --> 00:18:08,650
pheromone but they have a pheromone

460
00:18:14,880 --> 00:18:12,549
binding protein related protein yeah we

461
00:18:16,500 --> 00:18:14,890
love acronyms don't we as scientists so

462
00:18:18,240 --> 00:18:16,510
I don't quite know what they are but I

463
00:18:18,720 --> 00:18:18,250

analyzed them I wasn't getting any help

464

00:18:22,260 --> 00:18:18,730

there

465

00:18:24,390 --> 00:18:22,270

for me a regina calif or deer on the

466

00:18:26,539 --> 00:18:24,400

side of the road those maggots negative

467

00:18:29,580 --> 00:18:26,549

14 that's considered to be in the family

468

00:18:31,140 --> 00:18:29,590

cockroach here negative 3 and a thrips

469

00:18:33,810 --> 00:18:31,150

attacking your flowers coming at

470

00:18:35,510 --> 00:18:33,820

negative 10 again i'm in trouble they're

471

00:18:37,919 --> 00:18:35,520

not doing too well let us summarize

472

00:18:40,919 --> 00:18:37,929

pheromone binding protein charge summary

473

00:18:43,890 --> 00:18:40,929

we analyzed over 150 binding proteins

474

00:18:46,350 --> 00:18:43,900

but we only counted the proteins with a

475

00:18:48,450 --> 00:18:46,360

known signal peptide if we could not

476

00:18:53,789 --> 00:18:48,460

calculate the signal peptide we let it

477

00:18:55,470 --> 00:18:53,799

go of the 150 that we had nine percent

478

00:18:57,990 --> 00:18:55,480

of them were positive nine percent of

479

00:19:01,289 --> 00:18:58,000

them were neutral or zero and 82 percent

480

00:19:03,090 --> 00:19:01,299

were negatively charged PB peas as I

481

00:19:04,560 --> 00:19:03,100

said I'm competitive there's got to be

482

00:19:07,230 --> 00:19:04,570

something else going on here let me take

483

00:19:08,909 --> 00:19:07,240

a look at other binding proteins now

484

00:19:10,860 --> 00:19:08,919

there are the pheromone binding proteins

485

00:19:12,870 --> 00:19:10,870

which bind the pheromones there's also

486

00:19:15,270 --> 00:19:12,880

the odorant binding proteins which bind

487

00:19:17,820 --> 00:19:15,280

various odorants like plant odors I

488

00:19:20,669 --> 00:19:17,830

analyzed these two there's a lot more of

489

00:19:22,890 --> 00:19:20,679

them over 650 binding proteins were

490

00:19:24,870 --> 00:19:22,900

looked at only the odor and binding

491

00:19:26,760 --> 00:19:24,880

proteins and 1000 binding proteins and

492

00:19:30,480 --> 00:19:26,770

the general odor and binding proteins

493

00:19:34,950 --> 00:19:30,490

were used in this analysis but again I

494

00:19:37,860 --> 00:19:34,960

had 66% negatively charged 9% same as

495

00:19:40,220 --> 00:19:37,870

last time coming in at 0 and 25% coming

496

00:19:42,360 --> 00:19:40,230

in I was not getting consistent results

497

00:19:44,490 --> 00:19:42,370

and if I'm not getting consistent

498

00:19:46,890 --> 00:19:44,500

results I can't apply this to the

499

00:19:50,750 --> 00:19:46,900

original idea that I had of trying to

500

00:19:55,710 --> 00:19:50,760

speed up the process of diffusion via

501
00:19:57,690 --> 00:19:55,720
electrostatic attraction so in a sense

502
00:19:59,070 --> 00:19:57,700
you go back to the drawing board because

503
00:20:00,539 --> 00:19:59,080
there's a researcher you have to do this

504
00:20:02,770 --> 00:20:00,549
sometimes and you run up into roadblocks

505
00:20:04,480 --> 00:20:02,780
and as researchers are in

506
00:20:09,100 --> 00:20:04,490
more roadblocks than I run into positive

507
00:20:14,260 --> 00:20:09,110
results so I go back and I read the

508
00:20:16,420 --> 00:20:14,270
paper by Kyle and he says which I missed

509
00:20:18,460 --> 00:20:16,430
the first time was I guess it wasn't

510
00:20:20,860 --> 00:20:18,470
important to me at the time but there

511
00:20:23,260 --> 00:20:20,870
are fixed negative charges present on

512
00:20:25,630 --> 00:20:23,270
the inner cuticle of the sin silly in

513
00:20:27,670 --> 00:20:25,640

addition to being on the dendritic

514

00:20:30,970 --> 00:20:27,680

membrane well this is interesting news

515

00:20:34,120 --> 00:20:30,980

to know this is very interesting news to

516

00:20:37,960 --> 00:20:34,130

know what does that mean let me show you

517

00:20:40,680 --> 00:20:37,970

we now have electrostatic repulsion with

518

00:20:43,840 --> 00:20:40,690

my negatively charged binding proteins

519

00:20:46,480 --> 00:20:43,850

we've got negative charges on the inside

520

00:20:48,850 --> 00:20:46,490

of the cuticle we've got negative

521

00:20:51,670 --> 00:20:48,860

charges on the dendritic membrane my

522

00:20:53,590 --> 00:20:51,680

binding proteins are largely negative

523

00:20:59,770 --> 00:20:53,600

which means they're going to be repelled

524

00:21:01,930 --> 00:20:59,780

from both sides as a matter of fact

525

00:21:03,940 --> 00:21:01,940

they're gonna be repelled with one

526

00:21:05,350 --> 00:21:03,950

another they've got the same charges

527

00:21:08,050 --> 00:21:05,360

even if they're positively charged

528

00:21:10,000 --> 00:21:08,060

they're still going to be repelled from

529

00:21:12,280 --> 00:21:10,010

one another because of similar charges

530

00:21:14,890 --> 00:21:12,290

so I've got them being repelled from the

531

00:21:16,930 --> 00:21:14,900

sides this side that side I've got them

532

00:21:19,480 --> 00:21:16,940

being repelled from one another and so

533

00:21:21,970 --> 00:21:19,490

therefore we've set up this strange

534

00:21:24,540 --> 00:21:21,980

situation where instead of being able to

535

00:21:27,190 --> 00:21:24,550

travel or diffuse across the thin Siller

536

00:21:30,070 --> 00:21:27,200

I've now got all of this electrostatic

537

00:21:33,310 --> 00:21:30,080

repulsion going on which is now adding a

538

00:21:36,160 --> 00:21:33,320

certain amount of rigidity my fluid

539

00:21:38,860 --> 00:21:36,170

dynamics have changed I'm no longer

540

00:21:40,060 --> 00:21:38,870

dealing with a nice clean flowing water

541

00:21:41,470 --> 00:21:40,070

which is where all the diffusion

542

00:21:42,820 --> 00:21:41,480

coefficients are calculated from it's

543

00:21:45,820 --> 00:21:42,830

either air or water those are the only

544

00:21:47,590 --> 00:21:45,830

two we have now I've got this situation

545

00:21:48,700 --> 00:21:47,600

a little bit rigid which makes sense

546

00:21:50,680 --> 00:21:48,710

because I was talking to a German

547

00:21:52,600 --> 00:21:50,690

researcher who said that the inside of

548

00:21:54,280 --> 00:21:52,610

the sencilla is more like a gel than it

549

00:21:56,110 --> 00:21:54,290

is anything else I'm starting to agree

550

00:21:58,300 --> 00:21:56,120

with them now I had a conversation a few

551
00:22:00,940 --> 00:21:58,310
years ago because if you do not have

552
00:22:02,740 --> 00:22:00,950
movement then the pheromone binding

553
00:22:04,690 --> 00:22:02,750
protein is not going to be able to move

554
00:22:06,310 --> 00:22:04,700
to the inside imagine all these balloons

555
00:22:07,510 --> 00:22:06,320
getting in there you're not going to be

556
00:22:10,030 --> 00:22:07,520
able to get through all these balloons

557
00:22:12,130 --> 00:22:10,040
because of this rigidity right now which

558
00:22:14,140 --> 00:22:12,140
means diffusion has been compromised and

559
00:22:15,640 --> 00:22:14,150
I mean in a bad way which means the

560
00:22:16,210 --> 00:22:15,650
original diffusion coefficients that I

561
00:22:18,760 --> 00:22:16,220
calculate

562
00:22:20,350 --> 00:22:18,770
for the 2009 presentation are now in a

563
00:22:21,669 --> 00:22:20,360

completely different scale when I say

564

00:22:23,860 --> 00:22:21,679

completely different scale I mean really

565

00:22:26,649 --> 00:22:23,870

really low for those of you involved in

566

00:22:28,840 --> 00:22:26,659

SDS page you know that in that gel you

567

00:22:31,600 --> 00:22:28,850

will not get proteins moving through

568

00:22:34,120 --> 00:22:31,610

that gel unless you turn on the charges

569

00:22:35,409 --> 00:22:34,130

for those of you who dealt with SDS page

570

00:22:37,510 --> 00:22:35,419

before and if you've done enough of that

571

00:22:40,060 --> 00:22:37,520

then you know that every once in a while

572

00:22:41,740 --> 00:22:40,070

you forget to turn it on and so you come

573

00:22:43,419 --> 00:22:41,750

back and you analyze the gel with

574

00:22:45,220 --> 00:22:43,429

Coomassie brilliant blue and you realize

575

00:22:47,110 --> 00:22:45,230

oh shoot they're all stuck at the top I

576

00:22:49,960 --> 00:22:47,120

forgot to turn it on the reason is

577

00:22:54,760 --> 00:22:49,970

because proteins do not easily diffuse

578

00:22:55,560 --> 00:22:54,770

through a gel well great now what do I

579

00:22:57,669 --> 00:22:55,570

do

580

00:22:59,680 --> 00:22:57,679

there's two philosophical implications

581

00:23:01,480 --> 00:22:59,690

with this either binding occurs the

582

00:23:05,440 --> 00:23:01,490

pheromone gets to the dendritic membrane

583

00:23:06,310 --> 00:23:05,450

or doesn't one of the two it gets there

584

00:23:10,149 --> 00:23:06,320

or it does not

585

00:23:11,649 --> 00:23:10,159

if binding occurs technology has just

586

00:23:14,320 --> 00:23:11,659

not have found a way to show this yet

587

00:23:18,130 --> 00:23:14,330

that's the excuse I get when I go to

588

00:23:20,830 --> 00:23:18,140

conferences binding does not occur if

589

00:23:23,289 --> 00:23:20,840

that's the case then philosophically

590

00:23:27,610 --> 00:23:23,299

speaking detection of the pheromone must

591

00:23:31,390 --> 00:23:27,620

occur through some alternate means what

592

00:23:32,860 --> 00:23:31,400

is that alternate mean well there are

593

00:23:35,169 --> 00:23:32,870

two theories out there the lock and key

594

00:23:36,970 --> 00:23:35,179

model which most biologists are familiar

595

00:23:38,740 --> 00:23:36,980

with even non biologists I'm sure and

596

00:23:41,020 --> 00:23:38,750

then we have the vibrational Theory of

597

00:23:43,840 --> 00:23:41,030

odor which was brought out in 1930s by

598

00:23:46,990 --> 00:23:43,850

Dyson and has been resurrected a little

599

00:23:48,279 --> 00:23:47,000

bit today and so to take a look at the

600

00:23:49,720 --> 00:23:48,289

vibrational theory of odor there are

601
00:23:51,370 --> 00:23:49,730
certain conditions that need to be met

602
00:23:54,490 --> 00:23:51,380
if we're dealing with an electromagnetic

603
00:23:56,590 --> 00:23:54,500
signal then conditions must be met I've

604
00:23:58,810 --> 00:23:56,600
got some if-then statements right now

605
00:24:01,149 --> 00:23:58,820
let's follow along if this is

606
00:24:03,340 --> 00:24:01,159
electromagnetic then the message from

607
00:24:06,520 --> 00:24:03,350
the pheromone out here needs to get

608
00:24:08,890 --> 00:24:06,530
across the cuticle if this is

609
00:24:11,380 --> 00:24:08,900
electromagnetic then this message after

610
00:24:13,930 --> 00:24:11,390
it passes the cuticle must be able to

611
00:24:16,210 --> 00:24:13,940
pass through this entire watery matrix

612
00:24:19,720 --> 00:24:16,220
right there or this gel as I've just

613
00:24:22,480 --> 00:24:19,730

determined if this is an electromagnetic

614

00:24:24,000 --> 00:24:22,490

message then I must figure out some way

615

00:24:26,409 --> 00:24:24,010

in order to activate this receptor

616

00:24:29,110 --> 00:24:26,419

without the pheromone actually making

617

00:24:30,100 --> 00:24:29,120

contact with it those are my if-then

618

00:24:35,350 --> 00:24:30,110

statements if

619

00:24:36,700 --> 00:24:35,360

this is occurring electromagnetically is

620

00:24:38,980 --> 00:24:36,710

there some way for me to satisfy these

621

00:24:43,500 --> 00:24:38,990

conditions just take a look at some

622

00:24:45,490 --> 00:24:43,510

circumstantial evidence there's my first

623

00:24:48,100 --> 00:24:45,500

actually forgot to put these numbers up

624

00:24:53,080 --> 00:24:48,110

and there's the second region and the

625

00:24:54,970 --> 00:24:53,090

third region for effect dielectric if

626

00:24:56,770 --> 00:24:54,980

this is acting as a dielectric antenna

627

00:24:58,930 --> 00:24:56,780

as phil callahan the mechanism that has

628

00:25:00,940 --> 00:24:58,940

been put forward is shown then a

629

00:25:04,299 --> 00:25:00,950

dielectric according to the definition

630

00:25:05,980 --> 00:25:04,309

needs to have dye means two electric

631

00:25:08,169 --> 00:25:05,990

means that we have separate electrical

632

00:25:11,740 --> 00:25:08,179

charges on either side of a non

633

00:25:14,590 --> 00:25:11,750

conducting material excuse me the

634

00:25:16,419 --> 00:25:14,600

conductive material passes electrons

635

00:25:18,130 --> 00:25:16,429

freely so you have positive and negative

636

00:25:19,870 --> 00:25:18,140

charges on both sides it's not

637

00:25:22,330 --> 00:25:19,880

maintained but a dielectric material

638

00:25:24,310 --> 00:25:22,340

that which is insulated is able to

639

00:25:25,000 --> 00:25:24,320

maintain charges let's say positives on

640

00:25:28,480 --> 00:25:25,010

this side

641

00:25:31,299 --> 00:25:28,490

able to do that because of its

642

00:25:33,520 --> 00:25:31,309

dielectric properties a dielectric

643

00:25:35,110 --> 00:25:33,530

antenna is different than a conducting

644

00:25:36,789 --> 00:25:35,120

antenna although they can't pick up

645

00:25:39,880 --> 00:25:36,799

similar frequencies so if we're dealing

646

00:25:42,190 --> 00:25:39,890

with a dielectric antenna let me hit the

647

00:25:45,100 --> 00:25:42,200

literature again to see what I can find

648

00:25:46,570 --> 00:25:45,110

and there's not a whole lot of papers

649

00:25:48,940 --> 00:25:46,580

out there dealing in bio electro

650

00:25:52,360 --> 00:25:48,950

magnetics of insects but there are some

651
00:25:54,549 --> 00:25:52,370
so Ericsson back in 1975 I found found

652
00:25:56,350 --> 00:25:54,559
that the mean surface potential of

653
00:25:58,390 --> 00:25:56,360
honeybees varied throughout the daily

654
00:26:00,520 --> 00:25:58,400
flight period if the bees are leaving

655
00:26:04,590 --> 00:26:00,530
the hive they've got a surface charge

656
00:26:07,750 --> 00:26:04,600
between negative 14 millivolts to 8

657
00:26:09,520 --> 00:26:07,760
millivolts take-home message they're

658
00:26:11,650 --> 00:26:09,530
about zero a little bit positive a

659
00:26:14,020 --> 00:26:11,660
little bit negative after they're flying

660
00:26:16,180 --> 00:26:14,030
static charges are build up when the

661
00:26:21,250 --> 00:26:16,190
bees return from the hive they are

662
00:26:23,710 --> 00:26:21,260
universally positive they're between 13

663
00:26:25,419 --> 00:26:23,720

to 59 millivolts on the outside of their

664

00:26:27,100 --> 00:26:25,429

body when they come back from the hive

665

00:26:30,039 --> 00:26:27,110

after flying through the air

666

00:26:33,070 --> 00:26:30,049

take-home message here I've got positive

667

00:26:34,450 --> 00:26:33,080

charges on the outside of the insect so

668

00:26:37,840 --> 00:26:34,460

far so good that's something at least

669

00:26:39,549 --> 00:26:37,850

it's consistent remember this slide that

670

00:26:42,880 --> 00:26:39,559

I talked about before I said that

671

00:26:43,930 --> 00:26:42,890

they're well not I said but Kyle said

672

00:26:46,570 --> 00:26:43,940

fixed negative charges

673

00:26:48,930 --> 00:26:46,580

present on the inner cuticle of the sin

674

00:26:52,539 --> 00:26:50,080

wonderful

675

00:26:54,909 --> 00:26:52,549

I've got positives on one side I've got

676

00:26:56,950 --> 00:26:54,919

negatives on the other I was able to

677

00:26:58,570 --> 00:26:56,960

satisfy and I'm not going to talk about

678

00:27:00,549 --> 00:26:58,580

the other properties of a dielectric

679

00:27:03,190 --> 00:27:00,559

antenna why because I've talked about

680

00:27:04,570 --> 00:27:03,200

this before at SSA meetings but I just

681

00:27:06,279 --> 00:27:04,580

want to talk about this new evidence

682

00:27:09,039 --> 00:27:06,289

right now I've satisfied another

683

00:27:11,799 --> 00:27:09,049

condition of a dielectric antenna on the

684

00:27:13,419 --> 00:27:11,809

actual sencia itself now we've got the

685

00:27:15,730 --> 00:27:13,429

second part if I'm going to have an

686

00:27:17,430 --> 00:27:15,740

electromagnetic signal pass through a

687

00:27:19,720 --> 00:27:17,440

watery matrix how am I going to do that

688

00:27:22,659 --> 00:27:19,730

well some of you will say well you can't

689

00:27:25,450 --> 00:27:22,669

do that through water because deionized

690

00:27:27,009 --> 00:27:25,460

water doesn't conduct and I would say

691

00:27:27,940 --> 00:27:27,019

yeah you're right it doesn't conduct

692

00:27:30,039 --> 00:27:27,950

what about water

693

00:27:32,830 --> 00:27:30,049

well waters a little more conductive it

694

00:27:34,450 --> 00:27:32,840

depends Tom upon the various impurities

695

00:27:36,100 --> 00:27:34,460

that you have in there and you're right

696

00:27:38,639 --> 00:27:36,110

you can't get some conductivity of water

697

00:27:41,590 --> 00:27:38,649

but how can you make it more conductive

698

00:27:43,389 --> 00:27:41,600

take some salt take a salt shaker on top

699

00:27:45,159 --> 00:27:43,399

and start you know throw in the salt in

700

00:27:46,570 --> 00:27:45,169

and as you're putting more and more salt

701

00:27:49,960 --> 00:27:46,580

into the solution you will find that

702

00:27:52,659 --> 00:27:49,970

will become more conductive so if I'm

703

00:27:55,029 --> 00:27:52,669

gonna have a conducting fluid do I have

704

00:27:58,450 --> 00:27:55,039

these salts present in fact I do

705

00:27:59,470 --> 00:27:58,460

I mean this is just classic biological

706

00:28:01,060 --> 00:27:59,480

principles you know the ringers

707

00:28:03,810 --> 00:28:01,070

solutions these are all salt solutions

708

00:28:06,249 --> 00:28:03,820

so we have all of the salts necessary

709

00:28:07,779 --> 00:28:06,259

calcium plus 2 magnesium sodium

710

00:28:09,909 --> 00:28:07,789

potassium hydrogen

711

00:28:12,340 --> 00:28:09,919

we've got chlorine and hydroxide ions

712

00:28:14,649 --> 00:28:12,350

those are some of the classics which are

713

00:28:18,159 --> 00:28:14,659

found inside is so what I do have a salt

714

00:28:21,430 --> 00:28:18,169

solution however I the more salt I put

715

00:28:23,200 --> 00:28:21,440

in the more conductive it gets so how

716

00:28:25,720 --> 00:28:23,210

much salt can I stuff in this in order

717

00:28:28,090 --> 00:28:25,730

to make it conductive what additional

718

00:28:30,220 --> 00:28:28,100

charges can I put in here to make it

719

00:28:32,289 --> 00:28:30,230

more conductive than just a salt

720

00:28:35,200 --> 00:28:32,299

solution which by the way will satisfy

721

00:28:37,210 --> 00:28:35,210

my conditions what about the binding

722

00:28:38,409 --> 00:28:37,220

proteins I just spent a whole bunch of

723

00:28:40,060 --> 00:28:38,419

slides telling you about what an

724

00:28:42,399 --> 00:28:40,070

incredible failure I was at determining

725

00:28:44,830 --> 00:28:42,409

the positive nature of the binding

726

00:28:47,970 --> 00:28:44,840

proteins but can I use these to my

727

00:28:51,549 --> 00:28:47,980

advantage now I've got these charges

728

00:28:53,919 --> 00:28:51,559

sitting in my supposedly conducting

729

00:28:55,419 --> 00:28:53,929

fluid now some of you might say well I

730

00:28:56,950 --> 00:28:55,429

understand what you're saying time but

731

00:28:57,520 --> 00:28:56,960

didn't you just say some of them are

732

00:29:00,820 --> 00:28:57,530

zero

733

00:29:03,640 --> 00:29:00,830

oh yes I did but remember even the ones

734

00:29:06,460 --> 00:29:03,650

that were zero had negative and positive

735

00:29:09,310 --> 00:29:06,470

charges on them as a matter of fact the

736

00:29:14,800 --> 00:29:09,320

binding proteins are running between 30

737

00:29:16,540 --> 00:29:14,810

to 60 charges per molecule and the

738

00:29:20,470 --> 00:29:16,550

concentration of them is between 10 to

739

00:29:23,920 --> 00:29:20,480

20 mil american tration lots of charges

740

00:29:28,180 --> 00:29:23,930

on them so I've got this the makings of

741

00:29:31,110 --> 00:29:28,190

a very conductive fluid especially if

742

00:29:33,850 --> 00:29:31,120

it's more of a solid so if I get a nice

743

00:29:35,260 --> 00:29:33,860

matrix effect I'm gonna have a little

744

00:29:36,370 --> 00:29:35,270

bit of a crystalline effect and

745

00:29:38,470 --> 00:29:36,380

therefore it's gonna be even more

746

00:29:39,910 --> 00:29:38,480

conductive so I'm feeling good about

747

00:29:42,100 --> 00:29:39,920

this now let's move on to the third part

748

00:29:45,340 --> 00:29:42,110

what about the protein itself can the

749

00:29:48,870 --> 00:29:45,350

protein respond to an electromagnetic

750

00:29:53,080 --> 00:29:50,920

what do we know about these proteins

751

00:29:56,620 --> 00:29:53,090

well originally they were determined to

752

00:29:59,080 --> 00:29:56,630

be seven transmembrane proteins and so a

753

00:30:01,210 --> 00:29:59,090

classic G PCR which was originally what

754

00:30:03,610 --> 00:30:01,220

we thought they were a g-protein coupled

755

00:30:07,030 --> 00:30:03,620

receptor and this that they're all in

756

00:30:12,100 --> 00:30:07,040

the membrane of the phospholipid bilayer

757

00:30:14,680 --> 00:30:12,110

and the odorant receptors were

758

00:30:17,620 --> 00:30:14,690

originally placed in the Class A or

759

00:30:21,090 --> 00:30:17,630

class one rhodopsin like family of GPCRs

760

00:30:25,960 --> 00:30:21,100

however they could not be placed in

761

00:30:29,230 --> 00:30:25,970

subfamily a1 subfamily a7 or subfamily

762

00:30:31,990 --> 00:30:29,240

a16 they were given their own category

763

00:30:33,490 --> 00:30:32,000

they could not be placed in any so they

764

00:30:36,390 --> 00:30:33,500

looked like they were in the Class A

765

00:30:39,220 --> 00:30:36,400

rhodopsin by the way just to remind you

766

00:30:42,670 --> 00:30:39,230

response to electromagnetic energy but

767

00:30:43,930 --> 00:30:42,680

it looked like it was close to this but

768

00:30:46,330 --> 00:30:43,940

they were placed separately they were

769

00:30:47,950 --> 00:30:46,340

not actually called subfamily 8:20

770

00:30:50,410 --> 00:30:47,960

because they weren't too sure about it

771

00:30:51,610 --> 00:30:50,420

but they were placed there so this is

772

00:30:54,070 --> 00:30:51,620

what it looks like we've got a seven

773

00:30:56,560 --> 00:30:54,080

transmembrane molecule this is what all

774

00:30:59,620 --> 00:30:56,570

of them look like there is no

775

00:31:03,970 --> 00:30:59,630

variability just in the past couple

776

00:31:07,690 --> 00:31:03,980

years analysis of the odorant I'm sorry

777

00:31:09,940 --> 00:31:07,700

the ordinate receptors have shown that

778

00:31:10,990 --> 00:31:09,950

it may be a seven transmembrane membrane

779

00:31:17,320 --> 00:31:11,000

protein but

780

00:31:21,100 --> 00:31:17,330

it's backwards all GPCRs have the amino

781

00:31:25,000 --> 00:31:21,110

end outside a carbon end on the inside

782

00:31:27,340 --> 00:31:25,010

the ends and the C's were switched all

783

00:31:30,669 --> 00:31:27,350

of the odorant receptors and insects are

784

00:31:31,870 --> 00:31:30,679

backwards every one even as I'm standing

785

00:31:33,070 --> 00:31:31,880

before you for those who are watching

786

00:31:35,860 --> 00:31:33,080

this video right now are still

787

00:31:38,380 --> 00:31:35,870

scratching their heads wondering why the

788

00:31:40,690 --> 00:31:38,390

insects have just made this exception

789

00:31:46,779 --> 00:31:40,700

they are the only ones with a backwards

790

00:31:49,570 --> 00:31:46,789

odorant receptor so I get attacked

791

00:31:51,549 --> 00:31:49,580

sometimes this happens and one of them

792

00:31:54,159 --> 00:31:51,559

is that you know Tom you're wrong

793

00:31:55,960 --> 00:31:54,169

because we've been able to show that the

794

00:31:59,020 --> 00:31:55,970

lock and key is valid because we deal

795

00:32:02,140 --> 00:31:59,030

with xena pessoa sites for you Nam

796

00:32:04,450 --> 00:32:02,150

biologists its frog eggs so what they do

797

00:32:07,029 --> 00:32:04,460

there's our classic frog right there

798

00:32:08,860 --> 00:32:07,039

xena pissed Lavis and they didn't use

799

00:32:11,080 --> 00:32:08,870

these a lot in in biological

800

00:32:12,850 --> 00:32:11,090

laboratories and those are the eggs off

801

00:32:15,399 --> 00:32:12,860

to the right and what they do is they

802

00:32:18,039 --> 00:32:15,409

express proteins in these xena pessoa

803

00:32:19,810 --> 00:32:18,049

sites and then they analyze them it's a

804

00:32:21,279 --> 00:32:19,820

rather simple it's an elegant system

805

00:32:24,100 --> 00:32:21,289

what they do is they inject it I think

806

00:32:27,310 --> 00:32:24,110

it's with C RNA and it takes about 2 or

807

00:32:29,860 --> 00:32:27,320

3 days for them to express the proteins

808

00:32:32,020 --> 00:32:29,870

in the actual membrane of the frog egg

809

00:32:33,640 --> 00:32:32,030

and then you start testing the frog egg

810

00:32:35,230 --> 00:32:33,650

they actually start throwing odorants at

811

00:32:38,440 --> 00:32:35,240

it and looking to see if a response it's

812

00:32:40,240 --> 00:32:38,450

really kind of a neat system so they

813

00:32:41,950 --> 00:32:40,250

were able to do that they were able to

814

00:32:43,390 --> 00:32:41,960

take the odorant receptors now they did

815

00:32:45,460 --> 00:32:43,400

have to have the dimer because there are

816

00:32:47,320 --> 00:32:45,470

two proteins involved there's an O r83 B

817

00:32:49,779 --> 00:32:47,330

which is a co-receptor

818

00:32:52,330 --> 00:32:49,789

and similar to it which have just

819

00:32:54,850 --> 00:32:52,340

recently been called Orko's for odorant

820

00:32:56,950 --> 00:32:54,860

receptor co-receptors and these Orko's

821

00:32:59,740 --> 00:32:56,960

in addition to being expressed with the

822

00:33:02,590 --> 00:32:59,750

ordinate receptor now give a certain

823

00:33:04,750 --> 00:33:02,600

amount of activity to the frog eggs when

824

00:33:07,720 --> 00:33:04,760

you hit them with an odorant therefore

825

00:33:09,490 --> 00:33:07,730

Tom you are wrong because we've got the

826

00:33:11,860 --> 00:33:09,500

odorant we put it in this artificial

827

00:33:13,570 --> 00:33:11,870

system and we get a response from a frog

828

00:33:18,820 --> 00:33:13,580

egg and all we're doing is expressing

829

00:33:21,279 --> 00:33:18,830

the the protein and so that is some

830

00:33:22,870 --> 00:33:21,289

convincing evidence to be sure and so I

831

00:33:23,890 --> 00:33:22,880

turn to some of the individuals and I

832

00:33:26,920 --> 00:33:23,900

said well did you

833

00:33:29,050 --> 00:33:26,930

to a bush contact and so what do you

834

00:33:31,480 --> 00:33:29,060

mean contact I said did you establish

835

00:33:33,490 --> 00:33:31,490

contact between the pheromone and the

836

00:33:35,590 --> 00:33:33,500

receptor I understand it was expressed I

837

00:33:37,390 --> 00:33:35,600

get that I understand you exposed the

838

00:33:39,850 --> 00:33:37,400

odorant the appropriate odorant I get

839

00:33:43,540 --> 00:33:39,860

that too did you show contact between

840

00:33:45,850 --> 00:33:43,550

the pheromone well yeah I mean how else

841

00:33:49,150 --> 00:33:45,860

did it happen and maybe we put it there

842

00:33:51,850 --> 00:33:49,160

we got a reaction a depolarization so of

843

00:33:54,040 --> 00:33:51,860

course it contacted us said what process

844

00:33:55,780 --> 00:33:54,050

did you use to show contact how do you

845

00:33:57,940 --> 00:33:55,790

know that they made contact the person

846

00:34:05,550 --> 00:33:57,950

one of the persons got frustrated at me

847

00:34:05,560 --> 00:34:08,800

touching

848

00:34:14,659 --> 00:34:11,960

follow along my two hands are separated

849

00:34:17,960 --> 00:34:14,669

I bring them together they're now

850

00:34:21,430 --> 00:34:17,970

touching that to me is contact that's

851

00:34:25,820 --> 00:34:21,440

how I define contact was contact shown

852

00:34:29,060 --> 00:34:25,830

that conversation ended by the way so no

853

00:34:30,350 --> 00:34:29,070

contact was shown but what did was shown

854

00:34:32,630 --> 00:34:30,360

even though it's not the same reaction

855

00:34:37,490 --> 00:34:32,640

we're not getting clear spikes we did

856

00:34:39,740 --> 00:34:37,500

have activation the odorant and the

857

00:34:41,570 --> 00:34:39,750

ordered receptor we got activation in the

858

00:34:44,240 --> 00:34:41,580

Frog oocyte so how was it being

859

00:34:47,450 --> 00:34:44,250

activated we not sure if contact was

860

00:34:49,130 --> 00:34:47,460

made it might have been as I'm standing

861

00:34:52,790 --> 00:34:49,140

here right now in 2012 it might have

862

00:34:55,610 --> 00:34:52,800

been but it just wasn't shown and by the

863

00:35:00,140 --> 00:34:55,620

way this system only worked in a salt

864

00:35:01,400 --> 00:35:00,150

solution moving on to another study that

865

00:35:03,520 --> 00:35:01,410

I found take a look at the with the

866

00:35:06,800 --> 00:35:03,530

Japanese researchers bit did back in

867

00:35:09,290 --> 00:35:06,810

1985 evidence for non receptor odor

868

00:35:12,470 --> 00:35:09,300

discrimination using neuroblastoma cells

869

00:35:14,540 --> 00:35:12,480

as a model for a olfactory cells so

870

00:35:17,150 --> 00:35:14,550

we've got a model situation a very

871

00:35:20,270 --> 00:35:17,160

unnatural situation the excerpt from the

872

00:35:22,220 --> 00:35:20,280

abstract the mouse neuroblastoma cell

873

00:35:25,300 --> 00:35:22,230

which is independent of an olfactory

874

00:35:28,490 --> 00:35:25,310

cell was depolarized by 20 different

875

00:35:30,470 --> 00:35:28,500

odorants examined suggesting that

876

00:35:33,020 --> 00:35:30,480

specific proteins are not required for

877

00:35:35,870 --> 00:35:33,030

reception of odorants well this is kind

878

00:35:37,490 --> 00:35:35,880

of big because lock-and-key says that if

879

00:35:42,020 --> 00:35:37,500

you've got an odorant you need to have a

880

00:35:44,870 --> 00:35:42,030

very very specific odorant receptor it's

881

00:35:46,490 --> 00:35:44,880

lock and key after all and because it's

882

00:35:48,350 --> 00:35:46,500

locked in key it has to be specific I

883

00:35:50,420 --> 00:35:48,360

mean you change one small thing on an

884

00:35:54,050 --> 00:35:50,430

insect pheromone and you will change its

885

00:36:01,450 --> 00:35:54,060

receptivity forever so it is very

886

00:36:09,110 --> 00:36:04,070

let's get even a little bit simpler the

887

00:36:11,330 --> 00:36:09,120

frog eggs is a living entity but what if

888

00:36:13,550 --> 00:36:11,340

we can simplify the system even more so

889

00:36:15,170 --> 00:36:13,560

here we have a phospholipid bilayer the

890

00:36:17,450 --> 00:36:15,180

hydrophobic ends on the inside the

891

00:36:18,980 --> 00:36:17,460

hydrophilic ends on the outside most of

892

00:36:21,540 --> 00:36:18,990

you I think are aware of how all

893

00:36:24,300 --> 00:36:21,550

membranes are set up

894

00:36:26,280 --> 00:36:24,310

we can make these called liposomes and

895

00:36:30,180 --> 00:36:26,290

what these are is these are just a

896

00:36:31,350 --> 00:36:30,190

phospholipid bilayer and that's it what

897

00:36:33,990 --> 00:36:31,360

do you mean that's it Tom is there

898

00:36:35,910 --> 00:36:34,000

anything inside no is there DNA no

899

00:36:37,500 --> 00:36:35,920

there's there RNA no is there a nuclear

900

00:36:39,510 --> 00:36:37,510

membrane no there's not that either

901
00:36:42,150 --> 00:36:39,520
what about endoplasmic reticulum no

902
00:36:43,920 --> 00:36:42,160
mitochondria no is there anything inside

903
00:36:47,460 --> 00:36:43,930
no there's nothing inside it's just a

904
00:36:47,940 --> 00:36:47,470
phospholipid bilayer so what do you do

905
00:36:52,260 --> 00:36:47,950
with it

906
00:36:53,820 --> 00:36:52,270
I'll tell you here's the phospholipid

907
00:36:55,560 --> 00:36:53,830
bilayer I've blown it up right now we've

908
00:36:59,040 --> 00:36:55,570
got the two layers right there and you

909
00:37:01,440 --> 00:36:59,050
can insert membrane proteins into it

910
00:37:02,910 --> 00:37:01,450
well this is a nice simple system at

911
00:37:06,000 --> 00:37:02,920
least I don't deal with a frog right now

912
00:37:08,280 --> 00:37:06,010
so we get these liposomes you insert the

913
00:37:12,480 --> 00:37:08,290

the membrane protein in there and you

914

00:37:14,550 --> 00:37:12,490

can also play around with them so what

915

00:37:16,710 --> 00:37:14,560

do we have if we insert a membrane-bound

916

00:37:18,990 --> 00:37:16,720

protein into a liposome we create what

917

00:37:20,460 --> 00:37:19,000

is known as a pro do liposome I think

918

00:37:23,310 --> 00:37:20,470

you can understand the word derivation

919

00:37:28,740 --> 00:37:23,320

for that so if we have an insect o R and

920

00:37:30,540 --> 00:37:28,750

we then place through means all of these

921

00:37:33,480 --> 00:37:30,550

membrane bound proteins into it we can

922

00:37:35,010 --> 00:37:33,490

now test the liposome for its activity

923

00:37:37,200 --> 00:37:35,020

two different odorants a much simpler

924

00:37:40,800 --> 00:37:37,210

system than even the frog eggs what do

925

00:37:42,630 --> 00:37:40,810

we get we get activation so we express

926

00:37:44,400 --> 00:37:42,640

it in a liposome and we get activation

927

00:37:47,580 --> 00:37:44,410

which is a type of depolarization it's a

928

00:37:49,770 --> 00:37:47,590

subtle signal not quite the same by far

929

00:37:51,360 --> 00:37:49,780

as an in vivo situation but we're

930

00:37:57,240 --> 00:37:51,370

getting a reaction from it that's

931

00:37:59,190 --> 00:37:57,250

telling what about a random protein just

932

00:38:00,270 --> 00:37:59,200

got finished with that 1985 paper said

933

00:38:01,920 --> 00:38:00,280

they don't even using the right odor

934

00:38:03,750 --> 00:38:01,930

receptors and they got response what if

935

00:38:06,030 --> 00:38:03,760

I don't have random protein what would

936

00:38:08,370 --> 00:38:06,040

happen if I took a random protein and

937

00:38:10,500 --> 00:38:08,380

then put that in the liposome and then

938

00:38:13,110 --> 00:38:10,510

tested an odorant that we would assume

939

00:38:15,810 --> 00:38:13,120

is nowhere near related to it what would

940

00:38:19,710 --> 00:38:15,820

happen we would get a reaction as well

941

00:38:25,140 --> 00:38:19,720

why it's lock and key what's going on

942

00:38:30,420 --> 00:38:25,150

these odorants are they locking into

943

00:38:32,580 --> 00:38:30,430

every single protein that we give it no

944

00:38:34,770 --> 00:38:32,590

more in Kurihara in 1987 taking a look

945

00:38:35,040 --> 00:38:34,780

at liposomes as a model for all factory

946

00:38:36,960 --> 00:38:35,050

cell

947

00:38:39,330 --> 00:38:36,970

various odorants were found to

948

00:38:42,390 --> 00:38:39,340

depolarize and he's a particular type of

949

00:38:44,670 --> 00:38:42,400

liposomes as electron liposomes beautiful

950

00:38:46,830 --> 00:38:44,680

interesting stuff the lipid composition

951
00:38:48,240 --> 00:38:46,840
of the liposomes is one of the factors

952
00:38:50,550 --> 00:38:48,250
that controls the sensitivity to

953
00:38:52,200 --> 00:38:50,560
deodorants that makes sense to you

954
00:38:55,410 --> 00:38:52,210
change the phospholipid by a letter you

955
00:38:57,510 --> 00:38:55,420
change the properties three odorants

956
00:38:59,790 --> 00:38:57,520
change the membrane fluidity of the

957
00:39:03,540 --> 00:38:59,800
liposomes what does that mean the

958
00:39:07,110 --> 00:39:03,550
membrane fluidity is that it's it has

959
00:39:08,670 --> 00:39:07,120
become D structured shall we say why

960
00:39:11,190 --> 00:39:08,680
this is actually important because

961
00:39:15,510 --> 00:39:11,200
anytime you depolarize something you

962
00:39:17,100 --> 00:39:15,520
cause leakage leakage what do you mean

963
00:39:19,290 --> 00:39:17,110

leakage time you mean cell is leaking

964

00:39:22,650 --> 00:39:19,300

yes that's how all depolarizations occur

965

00:39:25,170 --> 00:39:22,660

ions leaked into the cell through an ion

966

00:39:26,870 --> 00:39:25,180

channel this leakage is necessary and

967

00:39:29,190 --> 00:39:26,880

part of this leakage is dependent upon

968

00:39:30,750 --> 00:39:29,200

destabilizing the membrane this is

969

00:39:33,330 --> 00:39:30,760

actually one of the prerequisites and

970

00:39:34,920 --> 00:39:33,340

was known back in 87 is that when you

971

00:39:37,920 --> 00:39:34,930

change the membrane fluidity of the

972

00:39:41,010 --> 00:39:37,930

liposomes you are now creating a sort of

973

00:39:43,920 --> 00:39:41,020

activation and finally the membrane

974

00:39:47,490 --> 00:39:43,930

fluidity was changed in concentration

975

00:39:49,530 --> 00:39:47,500

ranges of odorants similar to those were

976
00:39:52,080 --> 00:39:49,540
the membrane potential changes in a

977
00:39:54,750 --> 00:39:52,090
regular in vivo situation so it turns

978
00:39:57,060 --> 00:39:54,760
out that this is relatively accurate not

979
00:40:00,050 --> 00:39:57,070
too bad to work with two years later the

980
00:40:02,550 --> 00:40:00,060
same guys came up with another study

981
00:40:04,470 --> 00:40:02,560
their responses to or Durance and these

982
00:40:08,460 --> 00:40:04,480
lipo stones diminished at low

983
00:40:10,710 --> 00:40:08,470
concentrations of salts and recovered

984
00:40:11,910 --> 00:40:10,720
upon addition of salts to the

985
00:40:13,560 --> 00:40:11,920
stimulating solution

986
00:40:16,470 --> 00:40:13,570
I mentioned that salts were necessary

987
00:40:17,820 --> 00:40:16,480
for the Frog eggs this didn't really

988
00:40:19,260 --> 00:40:17,830

ruffle any feathers because people

989

00:40:22,620 --> 00:40:19,270

figure well it's a frog egg it needs to

990

00:40:23,910 --> 00:40:22,630

have some sort of ringers solution for

991

00:40:25,230 --> 00:40:23,920

it to work but the lipo stones don't

992

00:40:27,240 --> 00:40:25,240

need that I mean it's essentially just a

993

00:40:29,220 --> 00:40:27,250

dead phospholipid bilayer so you take

994

00:40:31,380 --> 00:40:29,230

away the salts you lose the effect why

995

00:40:33,570 --> 00:40:31,390

if it's lock and key what would the

996

00:40:36,150 --> 00:40:33,580

salts have to do with it why does the

997

00:40:40,920 --> 00:40:36,160

addition of salts bring it back as soon

998

00:40:43,560 --> 00:40:40,930

as you get removed them they also found

999

00:40:46,350 --> 00:40:43,570

that divalent cations divalent meaning

1000

00:40:48,280 --> 00:40:46,360

two were effective in supporting the

1001
00:40:51,880 --> 00:40:48,290
responses to odorants that much lower

1002
00:40:54,670 --> 00:40:51,890
sensations then mono valent cations one

1003
00:40:58,180 --> 00:40:54,680
one positive charge versus two positive

1004
00:41:00,610 --> 00:40:58,190
charge you see here the divalent cations

1005
00:41:03,550 --> 00:41:00,620
supported it at much lower

1006
00:41:06,760 --> 00:41:03,560
concentrations they increased the

1007
00:41:12,550 --> 00:41:06,770
sensitivity so when you increased the

1008
00:41:14,950 --> 00:41:12,560
charges of the in vitro situation you

1009
00:41:20,110 --> 00:41:14,960
increased its ability to detect the

1010
00:41:22,090 --> 00:41:20,120
odorant the next step was obviously as

1011
00:41:23,320 --> 00:41:22,100
well we've got ions going in and out I

1012
00:41:25,540 --> 00:41:23,330
mean the whole leakage thing you know

1013
00:41:29,650 --> 00:41:25,550

calcium influx this is how neurobiology

1014

00:41:33,330 --> 00:41:29,660

works what if we used impermeable

1015

00:41:35,950 --> 00:41:33,340

organic cations so we got those charges

1016

00:41:38,110 --> 00:41:35,960

which I'm suggesting are important but

1017

00:41:40,930 --> 00:41:38,120

they're impermeable so they can't get

1018

00:41:44,200 --> 00:41:40,940

inside the liposome which means they

1019

00:41:46,780 --> 00:41:44,210

can't be causing the depolarization

1020

00:41:49,330 --> 00:41:46,790

effect when they used impermeable

1021

00:41:52,990 --> 00:41:49,340

organic cations they were effective in

1022

00:41:55,630 --> 00:41:53,000

supporting the responses as well so the

1023

00:41:58,060 --> 00:41:55,640

response is not based upon an influx of

1024

00:42:00,640 --> 00:41:58,070

calcium ions you simply need to have the

1025

00:42:05,260 --> 00:42:00,650

charges on the outside in order for the

1026
00:42:07,090 --> 00:42:05,270
system to work and let's say this one is

1027
00:42:08,320 --> 00:42:07,100
nineteen ninety again Japanese

1028
00:42:10,710 --> 00:42:08,330
researchers I guess they're playing a

1029
00:42:14,530 --> 00:42:10,720
lot with liposomes over there in Japan

1030
00:42:16,540 --> 00:42:14,540
hate to talk to you about that we've got

1031
00:42:18,400 --> 00:42:16,550
some proteins right there and they were

1032
00:42:21,220 --> 00:42:18,410
able to show this effect as I told you

1033
00:42:24,190 --> 00:42:21,230
before but what if we took some of those

1034
00:42:26,740 --> 00:42:24,200
same proteins and got a little more

1035
00:42:29,020 --> 00:42:26,750
complicated well instead of having one

1036
00:42:30,940 --> 00:42:29,030
odorant receptor we had a whole bunch of

1037
00:42:32,650 --> 00:42:30,950
different proteins what happens then I

1038
00:42:35,110 --> 00:42:32,660

actually found out the Japanese

1039

00:42:38,650 --> 00:42:35,120

researchers that the more complex you

1040

00:42:41,800 --> 00:42:38,660

get the better they get at detecting

1041

00:42:45,250 --> 00:42:41,810

odorants how good in this study they use

1042

00:42:49,090 --> 00:42:45,260

12 different odorants the liposome this

1043

00:42:50,200 --> 00:42:49,100

dead Maalik molecule this i don't even

1044

00:42:52,270 --> 00:42:50,210

know what you want to call let's just

1045

00:42:54,370 --> 00:42:52,280

call it a liposome this liposome this

1046

00:42:56,020 --> 00:42:54,380

non living entity is responding to 12

1047

00:42:58,990 --> 00:42:56,030

different odorants that it hit it and

1048

00:43:01,940 --> 00:42:59,000

they were consistent odorant number

1049

00:43:04,460 --> 00:43:01,950

three was giving exactly the same

1050

00:43:06,589 --> 00:43:04,470

responds every single time to the point

1051

00:43:08,329 --> 00:43:06,599

where at the end of the study they could

1052

00:43:10,160 --> 00:43:08,339

tell which of the 12 ordinances was

1053

00:43:12,380 --> 00:43:10,170

based upon the response that they got to

1054

00:43:15,170 --> 00:43:12,390

the liposome and to answer your own

1055

00:43:17,089 --> 00:43:15,180

asked question no none of these proteins

1056

00:43:20,290 --> 00:43:17,099

that were used were classic odorant

1057

00:43:22,510 --> 00:43:20,300

receptors just random proteins

1058

00:43:24,609 --> 00:43:22,520

well this then moves on to some other

1059

00:43:29,930 --> 00:43:24,619

possibilities I mean if deed if this

1060

00:43:32,270 --> 00:43:29,940

conducting fluid is important then where

1061

00:43:37,700 --> 00:43:32,280

to go from here so I got a chance to

1062

00:43:39,200 --> 00:43:37,710

talk to a researcher at Georgia who does

1063

00:43:41,300 --> 00:43:39,210

work on decoupage decapod so our

1064

00:43:44,089 --> 00:43:41,310

lobsters crabs shrimp 10 legs

1065

00:43:47,180 --> 00:43:44,099

crustaceans and I was chatting with them

1066

00:43:50,599 --> 00:43:47,190

one time about the the sensory cells the

1067

00:43:53,060 --> 00:43:50,609

8th the tasks and they mentioned to me

1068

00:43:55,010 --> 00:43:53,070

that there's a way in order to make them

1069

00:43:56,750 --> 00:43:55,020

a NAS m'q which means they can't smell

1070

00:44:02,020 --> 00:43:56,760

and I said well how does that work he

1071

00:44:05,900 --> 00:44:02,030

goes you flush them with fresh water and

1072

00:44:06,470 --> 00:44:05,910

I thought and I said fresh water you're

1073

00:44:09,020 --> 00:44:06,480

kidding

1074

00:44:10,520 --> 00:44:09,030

I said does anybody else know about this

1075

00:44:13,339 --> 00:44:10,530

you know think it was such a big secret

1076

00:44:13,640 --> 00:44:13,349

it goes oh yeah we all do it you all do

1077

00:44:26,089 --> 00:44:13,650

it

1078

00:44:27,230 --> 00:44:26,099

take and he said at least 45 minutes so

1079

00:44:28,640 --> 00:44:27,240

we do that to kind of clear them out

1080

00:44:31,099 --> 00:44:28,650

it's kind of like a control type thing

1081

00:44:33,230 --> 00:44:31,109

and then once the the saline solution

1082

00:44:35,720 --> 00:44:33,240

because lobsters live in the ocean and

1083

00:44:37,190 --> 00:44:35,730

marine environment the the salt solution

1084

00:44:37,760 --> 00:44:37,200

gets back in there and everything is all

1085

00:44:40,220 --> 00:44:37,770

fine

1086

00:44:41,510 --> 00:44:40,230

and I thought really that's interesting

1087

00:44:43,490 --> 00:44:41,520

so I got a chance to talk to another

1088

00:44:45,740 --> 00:44:43,500

researcher also dealing with this issue

1089

00:44:47,420 --> 00:44:45,750

at the University of Florida and we were

1090

00:44:49,130 --> 00:44:47,430

chatting about blue crabs because blue

1091

00:44:52,099 --> 00:44:49,140

crabs are able to survive in a marine

1092

00:44:54,410 --> 00:44:52,109

environment salt and a freshwater

1093

00:44:57,020 --> 00:44:54,420

environment because they migrate they

1094

00:44:58,550 --> 00:44:57,030

could do both so I said well what

1095

00:45:00,740 --> 00:44:58,560

happens with the since Hilary cells and

1096

00:45:05,660 --> 00:45:00,750

and again just very quick off-the-cuff

1097

00:45:07,190 --> 00:45:05,670

it goes well they've got this salt

1098

00:45:09,380 --> 00:45:07,200

solution that they kind of move in and

1099

00:45:12,079 --> 00:45:09,390

out of the cell and the sensory cell at

1100

00:45:13,579 --> 00:45:12,089

will so as they're moving from the

1101
00:45:15,230 --> 00:45:13,589
marine environment up through the Great

1102
00:45:17,480 --> 00:45:15,240
Lakes for example

1103
00:45:19,910 --> 00:45:17,490
the actual change of the micro

1104
00:45:23,150 --> 00:45:19,920
environment inside the sensory cells is

1105
00:45:25,130 --> 00:45:23,160
actively changed by the blue-crab and

1106
00:45:27,260 --> 00:45:25,140
there's Gleason's paper in 2000

1107
00:45:29,660 --> 00:45:27,270
attesting to that effect I thought wow

1108
00:45:31,130 --> 00:45:29,670
this is really interesting too I mean

1109
00:45:32,839 --> 00:45:31,140
I'm an insect guy I don't usually deal

1110
00:45:34,460 --> 00:45:32,849
with decoupage but in this case I'll

1111
00:45:36,349 --> 00:45:34,470
take a look at this because there are

1112
00:45:38,750 --> 00:45:36,359
some similarities and differences

1113
00:45:40,880 --> 00:45:38,760

between the decapod sensory cells and

1114

00:45:42,770 --> 00:45:40,890

the insects sensory cells well taking

1115

00:45:44,810 --> 00:45:42,780

this idea then we should be able to come

1116

00:45:46,579 --> 00:45:44,820

to some conclusions I mean if this salt

1117

00:45:48,560 --> 00:45:46,589

solution is important supposedly as a

1118

00:45:51,410 --> 00:45:48,570

conducting fluid then we should be able

1119

00:45:54,829 --> 00:45:51,420

to come up with some if-then statements

1120

00:45:57,010 --> 00:45:54,839

if this is true then terrestrial insects

1121

00:46:01,280 --> 00:45:57,020

need to have this salt solution

1122

00:46:03,349 --> 00:46:01,290

therefore we've got the pores and there

1123

00:46:05,660 --> 00:46:03,359

shouldn't be a problem because it's in

1124

00:46:07,370 --> 00:46:05,670

air therefore I would expect them to

1125

00:46:09,200 --> 00:46:07,380

have the pores and that they would have

1126

00:46:11,450 --> 00:46:09,210

this micro environment of the salts and

1127

00:46:13,609 --> 00:46:11,460

they do there they do have pores in the

1128

00:46:15,829 --> 00:46:13,619

olfactory sense silly crustaceans

1129

00:46:17,870 --> 00:46:15,839

what about crustaceans can they have the

1130

00:46:19,430 --> 00:46:17,880

pores some might say well no because you

1131

00:46:20,510 --> 00:46:19,440

know everything would be leaking I was

1132

00:46:22,190 --> 00:46:20,520

like well I really want to be that bad

1133

00:46:24,079 --> 00:46:22,200

because the crustaceans are in a marine

1134

00:46:25,760 --> 00:46:24,089

environment and if they're in a marine

1135

00:46:27,920 --> 00:46:25,770

environment the salt solution is it's

1136

00:46:30,470 --> 00:46:27,930

getting in through the pores is still

1137

00:46:31,970 --> 00:46:30,480

going to be able to allow this to occur

1138

00:46:34,880 --> 00:46:31,980

that's not going to be a problem at all

1139

00:46:35,390 --> 00:46:34,890

so they do have pores in noël factories

1140

00:46:37,700 --> 00:46:35,400

in silly

1141

00:46:39,849 --> 00:46:37,710

what about aquatic insects insects are

1142

00:46:43,609 --> 00:46:39,859

not found in a marine environment

1143

00:46:45,920 --> 00:46:43,619

they're in freshwater what then there's

1144

00:46:47,960 --> 00:46:45,930

a curious thing of the what aquatic

1145

00:46:50,480 --> 00:46:47,970

insects had to go searching for this no

1146

00:46:53,030 --> 00:46:50,490

one really knows why but aquatic insects

1147

00:46:55,190 --> 00:46:53,040

do not have pores in their sencilla it's

1148

00:46:57,280 --> 00:46:55,200

just not there so therefore they're able

1149

00:47:00,320 --> 00:46:57,290

to maintain that micro environment and

1150

00:47:02,000 --> 00:47:00,330

is same aquatic insects once they come

1151
00:47:03,829 --> 00:47:02,010
out of the water like dragonflies stone

1152
00:47:08,109 --> 00:47:03,839
flies mayflies they come out and they're

1153
00:47:12,680 --> 00:47:10,880
so this is what's going on this is

1154
00:47:14,570 --> 00:47:12,690
what's going on there is some suggestion

1155
00:47:16,940 --> 00:47:14,580
right now some circumstantial evidence

1156
00:47:20,270 --> 00:47:16,950
new evidence that I'm supporting right

1157
00:47:22,089 --> 00:47:20,280
now to show that indeed we may have this

1158
00:47:24,500 --> 00:47:22,099
system actually occurring an

1159
00:47:26,839 --> 00:47:24,510
electromagnetic detection based upon

1160
00:47:28,090 --> 00:47:26,849
sound physical laws that could be

1161
00:47:39,850 --> 00:47:28,100
occurring in the end

1162
00:47:40,720 --> 00:47:39,860
sex and with that I am done time for a

1163
00:47:42,940 --> 00:47:40,730

few questions

1164

00:47:49,900 --> 00:47:42,950

Roger can you put the microphone over

1165

00:47:52,600 --> 00:47:49,910

there thank you this picture was also

1166

00:47:55,630 --> 00:47:52,610

taken a couple days ago she sent me two

1167

00:47:58,000 --> 00:47:55,640

pictures I had to choose I couldn't

1168

00:48:01,750 --> 00:47:58,010

choose go ahead

1169

00:48:05,890 --> 00:48:01,760

nice picture my name is Larissa Karen

1170

00:48:08,410 --> 00:48:05,900

and I want you to elaborate a little bit

1171

00:48:12,930 --> 00:48:08,420

of the poll on the possibility that the

1172

00:48:19,500 --> 00:48:12,940

olfactory mechanism is based on quantum

1173

00:48:23,740 --> 00:48:19,510

effect because they are not enough

1174

00:48:28,360 --> 00:48:23,750

protein conformational changes to

1175

00:48:31,230 --> 00:48:28,370

explain the large number of smells we

1176

00:48:34,450 --> 00:48:31,240

can recognize at least in human

1177

00:48:36,400 --> 00:48:34,460

olfactory system yes that's actually

1178

00:48:37,600 --> 00:48:36,410

gonna be outside my area of expertise

1179

00:48:39,790 --> 00:48:37,610

she's actually bringing out at the point

1180

00:48:41,890 --> 00:48:39,800

I think about the electron tunneling

1181

00:48:45,970 --> 00:48:41,900

theory that Luca Turin has come up with

1182

00:48:47,950 --> 00:48:45,980

there is more of a physical effect it

1183

00:48:50,230 --> 00:48:47,960

does not seem to be occurring with our

1184

00:48:51,880 --> 00:48:50,240

system because with his effect you have

1185

00:48:53,770 --> 00:48:51,890

to be between two plates for electron

1186

00:48:55,510 --> 00:48:53,780

tunneling to occur and it's through this

1187

00:48:58,060 --> 00:48:55,520

process that it is a quantum type of

1188

00:49:00,070 --> 00:48:58,070

effect whereas with this system because

1189

00:49:01,810 --> 00:49:00,080

it's occurring at a distance the

1190

00:49:04,780 --> 00:49:01,820

evidence to me seems to be more

1191

00:49:07,480 --> 00:49:04,790

electromagnetic than a pure quantum

1192

00:49:10,810 --> 00:49:07,490

effect so I would differentiate between

1193

00:49:12,490 --> 00:49:10,820

the two theories and suggest because I'm

1194

00:49:14,770 --> 00:49:12,500

not able to elaborate mostly so I'm

1195

00:49:15,610 --> 00:49:14,780

trying to dodge the question is that I

1196

00:49:16,870 --> 00:49:15,620

would think it would be more

1197

00:49:18,370 --> 00:49:16,880

electromagnetic and therefore we're

1198

00:49:20,560 --> 00:49:18,380

probably dealing with more of a wave

1199

00:49:23,140 --> 00:49:20,570

phenomena than we are with the quantum

1200

00:49:24,310 --> 00:49:23,150

type of phenomena although I still could

1201

00:49:30,780 --> 00:49:24,320

be wrong the jury's still out

1202

00:49:33,700 --> 00:49:30,790

thank you York Dobyms here you've been

1203

00:49:35,890 --> 00:49:33,710

challenging the paradigm for insect

1204

00:49:37,780 --> 00:49:35,900

olfaction for quite some time and in

1205

00:49:39,160 --> 00:49:37,790

this talk you just pointed out that

1206

00:49:39,730 --> 00:49:39,170

there's evidence for the same thing

1207

00:49:43,780 --> 00:49:39,740

going on

1208

00:49:46,930 --> 00:49:43,790

in other arthropods do you think that

1209

00:49:48,640 --> 00:49:46,940

there might be a similar challenge to

1210

00:49:53,370 --> 00:49:48,650

the lock and key model of olfaction

1211

00:49:59,170 --> 00:49:57,099

absolutely as a matter of fact am I able

1212

00:50:02,020 --> 00:49:59,180

to stop my answer with just that one

1213

00:50:04,570 --> 00:50:02,030

word because obviously I don't have

1214

00:50:07,359 --> 00:50:04,580

enough time to go into it but York thank

1215

00:50:10,170 --> 00:50:07,369

you for the question yes the answer is

1216

00:50:15,760 --> 00:50:13,240

Glenn Rhine and the question well first

1217

00:50:17,320 --> 00:50:15,770

the comment are you aware of ross ats

1218

00:50:19,390 --> 00:50:17,330

work back in the 80s where he

1219

00:50:22,030 --> 00:50:19,400

demonstrated that electromagnetic fields

1220

00:50:24,579 --> 00:50:22,040

affect membrane fluidity in neuronal

1221

00:50:26,020 --> 00:50:24,589

cells and are there other similar

1222

00:50:29,050 --> 00:50:26,030

studies that have been done with

1223

00:50:30,700 --> 00:50:29,060

olfaction using physical electromagnetic

1224

00:50:32,500 --> 00:50:30,710

fields to alter the processes you've

1225

00:50:34,480 --> 00:50:32,510

talked about well actually you've just

1226
00:50:38,740 --> 00:50:34,490
brought one up right now but to answer

1227
00:50:41,320 --> 00:50:38,750
your question for insects No yeah

1228
00:50:43,570 --> 00:50:41,330
for insects no but Ross's research and

1229
00:50:44,920 --> 00:50:43,580
others yes I mean you can play games

1230
00:50:47,260 --> 00:50:44,930
with electro magnetics and get the

1231
00:50:48,730 --> 00:50:47,270
responses however this can is usually

1232
00:50:50,079 --> 00:50:48,740
kind of scoffed at and like well you

1233
00:50:51,460 --> 00:50:50,089
know of course there's membrane

1234
00:50:52,690 --> 00:50:51,470
potentials and you're probably just

1235
00:50:54,670 --> 00:50:52,700
doing something really weird to it

1236
00:50:56,530 --> 00:50:54,680
something unnatural whereas you and I

1237
00:50:57,730 --> 00:50:56,540
might be saying oh no I don't think this

1238
00:50:59,790 --> 00:50:57,740

is unnatural at all I think there may

1239

00:51:02,079 --> 00:50:59,800

actually be something to it but

1240

00:51:05,349 --> 00:51:02,089

absolutely yes I am aware that there is

1241

00:51:07,300 --> 00:51:05,359

other research out there but I tend and

1242

00:51:08,770 --> 00:51:07,310

this may be a mistake of mine I tend to

1243

00:51:11,230 --> 00:51:08,780

stick with the entomological research

1244

00:51:13,390 --> 00:51:11,240

why because it's more convincing to the

1245

00:51:16,180 --> 00:51:13,400

entomologist so if you go too far away

1246

00:51:17,940 --> 00:51:16,190

from bugs people catch you and say well

1247

00:51:20,050 --> 00:51:17,950

you know I don't read that literature so

1248

00:51:21,930 --> 00:51:20,060

essentially you're discounted and you

1249

00:51:23,740 --> 00:51:21,940

really can't go anywhere but to bring in

1250

00:51:24,970 --> 00:51:23,750

decapod crustacean x'

1251

00:51:26,950 --> 00:51:24,980

because they're so close to their

1252

00:51:29,200 --> 00:51:26,960

arthropods they've got many strong

1253

00:51:30,730 --> 00:51:29,210

similarities between the thus in cilia

1254

00:51:33,579 --> 00:51:30,740

of insects and the eighth's the tasks of

1255

00:51:35,109 --> 00:51:33,589

the decapod crustacean x' then I think

1256

00:51:37,780 --> 00:51:35,119

that's a valid comparison to make and it

1257

00:51:39,880 --> 00:51:37,790

was a welcomed one too because I didn't

1258

00:51:41,920 --> 00:51:39,890

expect a similarity to occur it just

1259

00:51:43,030 --> 00:51:41,930

kind of fell in my lap I decided to go

1260

00:51:45,160 --> 00:51:43,040

with it and that's why I threw up a

1261

00:51:47,560 --> 00:51:45,170

couple slides for your benefit and for

1262

00:51:50,550 --> 00:51:47,570

the benefit of those who are taking a