

1
00:00:00,000 --> 00:00:04,019
Oh am I telling you anything you don't

2
00:00:01,560 --> 00:00:05,459
know no I'm not for those of you who

3
00:00:04,019 --> 00:00:07,559
walked in the mall you pass by those

4
00:00:05,459 --> 00:00:08,939
little candle shops and you're like wow

5
00:00:07,559 --> 00:00:10,259
we've got some nice odors coming out of

6
00:00:08,939 --> 00:00:12,330
you walk into the store and you start

7
00:00:10,259 --> 00:00:14,548
smelling the candles it's really nice so

8
00:00:12,330 --> 00:00:16,890
they got some really pretty smells in

9
00:00:14,548 --> 00:00:18,660
them various aldehydes maybe ketones and

10
00:00:16,890 --> 00:00:22,019
what's happening right now well you

11
00:00:18,660 --> 00:00:23,460
smell them but they're mostly most of

12
00:00:22,019 --> 00:00:25,259
these odorants are inside the candle

13
00:00:23,460 --> 00:00:27,000
they're held fast and the reason why

14
00:00:25,260 --> 00:00:29,580
they're held fast is because it's a

15
00:00:27,000 --> 00:00:31,859
solid and because it's a solid they're

16
00:00:29,579 --> 00:00:35,308
not diffusing out you wanted to diffuse

17
00:00:31,859 --> 00:00:38,039
out what do you do you light it so if I

18
00:00:35,308 --> 00:00:39,869
the candle up here maybe York and Mark

19
00:00:38,039 --> 00:00:41,219
would be able to smell it but for the

20
00:00:39,869 --> 00:00:42,750
people in the back I'm going to have to

21
00:00:41,219 --> 00:00:44,340
light this candle is in five minutes

22
00:00:42,750 --> 00:00:45,808
everyone in this room is going to know

23
00:00:44,340 --> 00:00:47,940
exactly what odor is found in that

24
00:00:45,808 --> 00:00:50,218
candle what did I do I just changes the

25
00:00:47,939 --> 00:00:52,259
state and went from a solid to a liquid

26
00:00:50,219 --> 00:00:55,829
state the odorants now have an

27
00:00:52,259 --> 00:00:57,659
opportunity to release so how long does

28
00:00:55,829 --> 00:01:01,230
it take to diffuse through the wax it's

29

00:00:57,659 --> 00:01:04,109
not applicable it doesn't apply we're

30
00:01:01,229 --> 00:01:06,118
dealing with a solid so reasonably you

31
00:01:04,109 --> 00:01:08,010
could say it might take minutes under

32
00:01:06,118 --> 00:01:10,409
certain circumstances it might take

33
00:01:08,010 --> 00:01:12,090
hours there's literature saying that the

34
00:01:10,409 --> 00:01:13,469
pheromone sits for an hour and a half on

35
00:01:12,090 --> 00:01:15,420
the outside of the insects and cilla

36
00:01:13,469 --> 00:01:17,789
this would seem to be supported by the

37
00:01:15,420 --> 00:01:19,228
physical evidence right now and so this

38
00:01:17,790 --> 00:01:21,000
might take Minister our some of you

39
00:01:19,228 --> 00:01:23,879
might be saying well your presentation

40
00:01:21,000 --> 00:01:25,319
is over tom you're done your goal of one

41
00:01:23,879 --> 00:01:26,728
to ten milliseconds has been completely

42
00:01:25,319 --> 00:01:28,319
blown all the water right now so why

43
00:01:26,728 --> 00:01:29,789

don't you just sit down however you can

44

00:01:28,319 --> 00:01:33,658

see I've got some other steps to go and

45

00:01:29,790 --> 00:01:35,070

York hasn't told me to sit down yet so

46

00:01:33,659 --> 00:01:37,320

what's our next step the next step is

47

00:01:35,069 --> 00:01:38,789

time to diffuse through the pores well

48

00:01:37,319 --> 00:01:41,219

it has to diffuse through the pores but

49

00:01:38,790 --> 00:01:43,380

has to get to the pores this is a

50

00:01:41,219 --> 00:01:46,920

representative sencilla track odia from

51

00:01:43,379 --> 00:01:49,709

bombyx mori the silkworm can you see the

52

00:01:46,920 --> 00:01:53,519

pores maybe not let me point them out to

53

00:01:49,709 --> 00:01:56,489

you one two three four this is drawn to

54

00:01:53,519 --> 00:01:59,819

scale this is drawn to scale so when the

55

00:01:56,489 --> 00:02:02,640

pheromone hits the sencilla try codya

56

00:01:59,819 --> 00:02:05,039

most of them get stuck on the outside

57

00:02:02,640 --> 00:02:07,349

most of them don't go inside the pores

58
00:02:05,040 --> 00:02:09,539
and therefore most of them are going to

59
00:02:07,349 --> 00:02:12,870
have to migrate in some way through a

60
00:02:09,538 --> 00:02:16,509
solid crystalline waxy layer

61
00:02:12,870 --> 00:02:18,219
borderline impossible and so time to

62
00:02:16,509 --> 00:02:19,539
diffuse through the pores unknown no

63
00:02:18,219 --> 00:02:21,699
one's ever actually looked at anything

64
00:02:19,539 --> 00:02:23,530
like that before what about the time to

65
00:02:21,699 --> 00:02:25,179
bind a pheromone what's the process

66
00:02:23,530 --> 00:02:26,590
there well fortunately this has been

67
00:02:25,180 --> 00:02:29,319
looked at a little bit more the

68
00:02:26,590 --> 00:02:31,450
pheromone binding protein binds very

69
00:02:29,319 --> 00:02:32,500
well to the pheromone you put the

70
00:02:31,449 --> 00:02:34,389
pheromone binding protein in the

71
00:02:32,500 --> 00:02:37,120
pheromone together and they will become

72
00:02:34,389 --> 00:02:38,529
a couple like that so that's not a

73
00:02:37,120 --> 00:02:40,210
problem at all that'll turn about one

74
00:02:38,530 --> 00:02:43,180
millisecond so we're doing pretty good

75
00:02:40,210 --> 00:02:44,830
there time to transport the pheromone

76
00:02:43,180 --> 00:02:47,439
now remember it's not the pheromone that

77
00:02:44,830 --> 00:02:49,060
I'm transporting it's the pheromone and

78
00:02:47,439 --> 00:02:51,069
the pheromone binding protein because

79
00:02:49,060 --> 00:02:53,319
it's a complex and because it's a

80
00:02:51,069 --> 00:02:56,349
complex that's a big molecule the bigger

81
00:02:53,319 --> 00:02:57,250
the molecule the slower the diffusion so

82
00:02:56,349 --> 00:02:59,829
that's what I'm going to have to

83
00:02:57,250 --> 00:03:02,139
transport to the other side so I'll hit

84
00:02:59,830 --> 00:03:04,960
the literature 1993 brune and Kim have a

85
00:03:02,139 --> 00:03:06,519
nice article that I could look at and

86

00:03:04,960 --> 00:03:09,400
make some extrapolations from predicting

87
00:03:06,520 --> 00:03:11,170
protein diffusion coefficients for those

88
00:03:09,400 --> 00:03:12,939
of you who may not be aware of this you

89
00:03:11,169 --> 00:03:15,369
have to to foot diffusion coefficients

90
00:03:12,939 --> 00:03:16,689
one is an air theatres and water so I'm

91
00:03:15,370 --> 00:03:18,099
interested in the one in water because

92
00:03:16,689 --> 00:03:20,710
that mostly closely resembles when I'm

93
00:03:18,099 --> 00:03:22,479
looking for so I take a look is it a rod

94
00:03:20,710 --> 00:03:24,490
or is it a globular protein mine is a

95
00:03:22,479 --> 00:03:26,799
globular protein it's about 14 killer

96
00:03:24,490 --> 00:03:28,840
Dalton's diffuses across my sin Siller

97
00:03:26,800 --> 00:03:30,189
space I find out according to the

98
00:03:28,840 --> 00:03:33,460
literature it's going to take about 10

99
00:03:30,189 --> 00:03:34,840
to 12 milliseconds for that complex to

100
00:03:33,460 --> 00:03:37,689

make it across that space to the

101

00:03:34,840 --> 00:03:39,520

dendrite and really did I make some big

102

00:03:37,689 --> 00:03:41,199

mistakes right now let me point them out

103

00:03:39,520 --> 00:03:42,939

to you for those of you are not aware

104

00:03:41,199 --> 00:03:45,310

these are some of the mistakes I made

105

00:03:42,939 --> 00:03:47,859

some invalid assumptions with that one

106

00:03:45,310 --> 00:03:49,569

can I make a linear extrapolation the

107

00:03:47,860 --> 00:03:51,730

diffusion is a two dimensional molecule

108

00:03:49,569 --> 00:03:54,969

can I make a linear extrapolation 23

109

00:03:51,729 --> 00:03:56,829

know that there is a diffusion gradient

110

00:03:54,969 --> 00:03:58,270

I'm assuming that there's a diffusion

111

00:03:56,830 --> 00:03:59,980

gradient and there is not a diffusion

112

00:03:58,270 --> 00:04:01,990

gradient there is a much higher amount

113

00:03:59,979 --> 00:04:03,849

inside than there is outside so that's

114

00:04:01,990 --> 00:04:05,620

blown out of the water I'm assuming that

115
00:04:03,849 --> 00:04:07,719
there's a pure water solvent that's not

116
00:04:05,620 --> 00:04:09,460
pure water there's a lot of stuff in

117
00:04:07,719 --> 00:04:11,590
there and it is not pure water and

118
00:04:09,460 --> 00:04:13,360
therefore it becomes more like a gel as

119
00:04:11,590 --> 00:04:16,000
that individual of last month told me

120
00:04:13,360 --> 00:04:18,189
about to I assume that no bound water

121
00:04:16,000 --> 00:04:21,029
molecules occur to the PBP or the

122
00:04:18,189 --> 00:04:23,379
pheromone binding protein well they do I

123
00:04:21,029 --> 00:04:25,429
assume that there's no dendritic sheath

124
00:04:23,379 --> 00:04:27,560
yes there's actually a sheaths around

125
00:04:25,430 --> 00:04:28,699
dendrites that's also a problem how does

126
00:04:27,560 --> 00:04:30,500
a pheromone and the pheromone binding

127
00:04:28,699 --> 00:04:31,699
protein get through that and I'm

128
00:04:30,500 --> 00:04:33,610
assuming that there's no change in

129
00:04:31,699 --> 00:04:38,030
temperature or viscosity over time all

130
00:04:33,610 --> 00:04:39,259
invalid assumptions so because I can't

131
00:04:38,029 --> 00:04:41,599
make this assumption why am I making

132
00:04:39,259 --> 00:04:42,830
this assumption at all well all I have

133
00:04:41,600 --> 00:04:44,720
to work with right now is 10 to 12

134
00:04:42,829 --> 00:04:47,389
milliseconds there's no way to work with

135
00:04:44,720 --> 00:04:48,800
anything else so I'm just going to tell

136
00:04:47,389 --> 00:04:51,050
you right now the time to transport the

137
00:04:48,800 --> 00:04:53,870
pheromone is going to be a minimum of 10

138
00:04:51,050 --> 00:04:56,060
milliseconds it doesn't matter to me I

139
00:04:53,870 --> 00:04:59,090
don't care whether or not it actually

140
00:04:56,060 --> 00:05:02,000
takes 11 milliseconds or a hundred

141
00:04:59,089 --> 00:05:04,250
thousand milliseconds I don't care all i

142
00:05:02,000 --> 00:05:06,649
care about is that it's not faster than

143

00:05:04,250 --> 00:05:10,910
10 milliseconds right now and that i can

144
00:05:06,649 --> 00:05:12,859
make with some certainty so the time to

145
00:05:10,910 --> 00:05:14,810
dissociate from the pheromone what about

146
00:05:12,860 --> 00:05:17,150
this has this been looked at fortunately

147
00:05:14,810 --> 00:05:18,978
it has time to dissociate from the

148
00:05:17,149 --> 00:05:21,679
pheromone how does this happen well we

149
00:05:18,978 --> 00:05:23,478
do know that it can dissociate but there

150
00:05:21,680 --> 00:05:24,860
are some problems as you might imagine

151
00:05:23,478 --> 00:05:27,168
there's been problems throughout my

152
00:05:24,860 --> 00:05:28,970
entire talk here some more the problem

153
00:05:27,168 --> 00:05:30,740
is this once the pheromone binds with a

154
00:05:28,970 --> 00:05:35,449
pheromone binding protein we got a

155
00:05:30,740 --> 00:05:39,168
classic pH of 7 it migrates across

156
00:05:35,449 --> 00:05:41,478
simple understand and it binds to the

157
00:05:39,168 --> 00:05:44,839

purported receptor now it must associate

158

00:05:41,478 --> 00:05:48,918

well how does it do that the association

159

00:05:44,839 --> 00:05:50,209

only occurs at a pH of 5 there is no

160

00:05:48,918 --> 00:05:51,859

separation between the pheromone

161

00:05:50,209 --> 00:05:54,978

pheromone binding protein it binds

162

00:05:51,860 --> 00:05:56,449

strongly it binds so strongly that the

163

00:05:54,978 --> 00:05:57,439

Germans Carl Casan that talked about

164

00:05:56,449 --> 00:05:59,658

right now feels that it doesn't

165

00:05:57,439 --> 00:06:01,550

associate at all he actually feels the

166

00:05:59,658 --> 00:06:02,949

whole thing as a complex gets there

167

00:06:01,550 --> 00:06:06,408

because it really cannot dissociate

168

00:06:02,949 --> 00:06:08,569

however Walter Leal California pH of 5

169

00:06:06,408 --> 00:06:11,719

this is how it separates well where is a

170

00:06:08,569 --> 00:06:13,000

pH of 5 does anyone have a pH of 5

171

00:06:11,720 --> 00:06:16,099

running through their blood I hope not

172
00:06:13,000 --> 00:06:19,459
cuz you're not healthy so where is the

173
00:06:16,098 --> 00:06:22,009
physiological pH the pH of 5 is located

174
00:06:19,459 --> 00:06:25,098
right here along the membrane so you

175
00:06:22,009 --> 00:06:27,319
must have contact with the membrane then

176
00:06:25,098 --> 00:06:30,439
the molecule recognizes it as being at a

177
00:06:27,319 --> 00:06:32,598
ph of 5 environment ok and then

178
00:06:30,439 --> 00:06:35,149
dissociation occurs and then it makes

179
00:06:32,598 --> 00:06:36,800
its way to the receptor well this is a

180
00:06:35,149 --> 00:06:39,829
little difficult to swallow but this is

181
00:06:36,800 --> 00:06:43,660
what's being reported right now

182
00:06:39,829 --> 00:06:47,750
and this occurs in nine milliseconds if

183
00:06:43,660 --> 00:06:51,410
we have a pH of five if we don't have a

184
00:06:47,750 --> 00:06:54,189
pH of five the half-life of dissociation

185
00:06:51,410 --> 00:06:58,189
is about 100 seconds not milliseconds

186
00:06:54,189 --> 00:06:59,689
seconds this will not separate so do I

187
00:06:58,189 --> 00:07:01,699
go with the nine millisecond figure

188
00:06:59,689 --> 00:07:03,920
doesn't really matter as you can see

189
00:07:01,699 --> 00:07:07,759
right now or do I go with 100 second

190
00:07:03,920 --> 00:07:09,710
figure that's your choice and time to

191
00:07:07,759 --> 00:07:10,909
activate the receptor well that doesn't

192
00:07:09,709 --> 00:07:13,039
take long at all probably on the order

193
00:07:10,910 --> 00:07:14,360
of about 50 picoseconds receptors

194
00:07:13,040 --> 00:07:16,939
activate pretty quickly so that's not

195
00:07:14,360 --> 00:07:18,230
really a major problem in the theory but

196
00:07:16,939 --> 00:07:19,939
we're dealing with something which is

197
00:07:18,230 --> 00:07:23,600
very very quick therefore significantly

198
00:07:19,939 --> 00:07:28,009
less than one millisecond thank you very

199
00:07:23,600 --> 00:07:31,090
much and so some of you are not

200

00:07:28,009 --> 00:07:33,560
convinced why because you're the SSC

201
00:07:31,089 --> 00:07:35,209
because you're the SSC some of you are

202
00:07:33,560 --> 00:07:36,649
skeptical some of you are not buying

203
00:07:35,209 --> 00:07:38,750
what I'm telling you right now some of

204
00:07:36,649 --> 00:07:41,329
you are convinced thank you some of you

205
00:07:38,750 --> 00:07:43,149
are not but you're you might be a normal

206
00:07:41,329 --> 00:07:45,319
run-of-the-mill skeptic and that's fine

207
00:07:43,149 --> 00:07:46,759
some of you might be a pathological

208
00:07:45,319 --> 00:07:49,129
skeptic and I can't do anything for you

209
00:07:46,759 --> 00:07:51,170
but for you normal everyday

210
00:07:49,129 --> 00:07:53,569
run-of-the-mill skeptics right now I

211
00:07:51,170 --> 00:07:55,879
want you to chew on this take a look at

212
00:07:53,569 --> 00:07:57,980
neural transmitter synaptic transmission

213
00:07:55,879 --> 00:08:00,199
let's take a look and find out how long

214
00:07:57,980 --> 00:08:02,360

this process takes a process we've just

215

00:08:00,199 --> 00:08:03,829

been known for decades and is exactly

216

00:08:02,360 --> 00:08:08,629

the same process that is being talked

217

00:08:03,829 --> 00:08:10,759

about in the insects one there's a major

218

00:08:08,629 --> 00:08:12,829

difference between the two the synapse

219

00:08:10,759 --> 00:08:14,300

acetylcholine synapsin I'm talking about

220

00:08:12,829 --> 00:08:15,769

there's type 1 and type 2 receptors I'm

221

00:08:14,300 --> 00:08:18,530

talking about the one it's 20 nanometers

222

00:08:15,769 --> 00:08:22,339

long is going to diffuse over the course

223

00:08:18,529 --> 00:08:24,469

of 20 nanometers my insect is diffusing

224

00:08:22,339 --> 00:08:26,299

over the course of between 11 hundred

225

00:08:24,470 --> 00:08:30,410

and fifty to two thousand nanometers

226

00:08:26,300 --> 00:08:32,360

close one to two micrometers or that's a

227

00:08:30,410 --> 00:08:33,379

huge difference right now that would

228

00:08:32,360 --> 00:08:34,759

seem to make a difference right there

229
00:08:33,379 --> 00:08:36,649
but let's take a look at the time course

230
00:08:34,759 --> 00:08:38,569
of events arrival of the excitatory

231
00:08:36,649 --> 00:08:41,629
impulse again we'll assign that at zero

232
00:08:38,570 --> 00:08:42,890
milliseconds the binding of the vesicle

233
00:08:41,629 --> 00:08:45,139
to the membrane and release of

234
00:08:42,889 --> 00:08:47,419
neurotransmitter we have got it down to

235
00:08:45,139 --> 00:08:49,730
between three to five milliseconds right

236
00:08:47,419 --> 00:08:51,289
now so it's not faster than three and

237
00:08:49,730 --> 00:08:52,970
it's certainly not lower than five I

238
00:08:51,289 --> 00:08:53,339
think that the resolution might be

239
00:08:52,970 --> 00:08:54,330
working

240
00:08:53,340 --> 00:08:55,950
a little bit better and there may be

241
00:08:54,330 --> 00:08:57,690
some neurophysiologist who know more

242
00:08:55,950 --> 00:09:00,210
about this than I do but we're at three

243
00:08:57,690 --> 00:09:02,640
to five milliseconds right now diffusion

244
00:09:00,210 --> 00:09:04,560
across the synaptic cleft the 20

245
00:09:02,639 --> 00:09:06,059
nanometers and The Binding of the

246
00:09:04,559 --> 00:09:08,039
neurotransmitter to the receptor they

247
00:09:06,059 --> 00:09:09,629
have not been able to separate all

248
00:09:08,039 --> 00:09:12,689
together that's zero point three

249
00:09:09,629 --> 00:09:14,669
milliseconds take-home message it takes

250
00:09:12,690 --> 00:09:17,160
three point three to five point three

251
00:09:14,669 --> 00:09:20,519
milliseconds for synaptic transmission

252
00:09:17,159 --> 00:09:22,799
and you're telling me that an insect is

253
00:09:20,519 --> 00:09:28,409
smelling as fast as synaptic

254
00:09:22,799 --> 00:09:30,149
transmission no I am not buying that so

255
00:09:28,409 --> 00:09:31,860
one of my conclusions well I think my

256
00:09:30,149 --> 00:09:33,539
conclusion should be obvious either the

257

00:09:31,860 --> 00:09:36,149
current theory of insect olfaction needs

258
00:09:33,539 --> 00:09:39,149
to be modified in order to include one

259
00:09:36,149 --> 00:09:40,620
or more mechanisms in addition to simple

260
00:09:39,149 --> 00:09:42,629
diffusion because that's all I've got to

261
00:09:40,620 --> 00:09:44,730
work with right now simple diffusion or

262
00:09:42,629 --> 00:09:46,789
current theory needs to be replaced by a

263
00:09:44,730 --> 00:09:49,789
new theory that supports the

264
00:09:46,789 --> 00:09:51,809
electrophysiological or temporal data

265
00:09:49,789 --> 00:09:54,559
that's all I wrote thank you very much

266
00:09:51,809 --> 00:09:54,559
appreciate it