



1  
00:00:03,990 --> 00:00:01,829  
oh am i telling you anything you don't

2  
00:00:05,590 --> 00:00:04,000  
know no i'm not for those of you who

3  
00:00:07,430 --> 00:00:05,600  
walked in the mall you passed by those

4  
00:00:08,790 --> 00:00:07,440  
uh little candle shops and you're like

5  
00:00:09,990 --> 00:00:08,800  
wow there's got some nice odors coming

6  
00:00:11,350 --> 00:00:10,000  
out of you walk into the store and you

7  
00:00:13,910 --> 00:00:11,360  
start smelling the candles it's really

8  
00:00:16,070 --> 00:00:13,920  
nice so they got some really pretty

9  
00:00:18,150 --> 00:00:16,080  
smells in them various aldehydes maybe

10  
00:00:21,510 --> 00:00:18,160  
ketones and what's happening right now

11  
00:00:22,950 --> 00:00:21,520  
well you smell them but they're mostly

12  
00:00:25,029 --> 00:00:22,960  
most of these odorants are inside the

13  
00:00:27,109 --> 00:00:25,039

candle they're held fast and the reason

14

00:00:29,429 --> 00:00:27,119

why they're held fast is because it's a

15

00:00:31,429 --> 00:00:29,439

solid and because it's a solid they're

16

00:00:33,590 --> 00:00:31,439

not diffusing out you want them to

17

00:00:35,910 --> 00:00:33,600

diffuse out what do you do

18

00:00:38,389 --> 00:00:35,920

you light it so if i had a candle up

19

00:00:40,310 --> 00:00:38,399

here maybe york and mark would be able

20

00:00:41,990 --> 00:00:40,320

to smell it but for the people in the

21

00:00:43,990 --> 00:00:42,000

back i'm gonna have to light this candle

22

00:00:45,510 --> 00:00:44,000

in five minutes everyone in this room is

23

00:00:47,510 --> 00:00:45,520

going to know exactly what odor is found

24

00:00:49,990 --> 00:00:47,520

in that candle what did i do i just

25

00:00:52,229 --> 00:00:50,000

changed the state i went from a solid to

26  
00:00:54,549 --> 00:00:52,239  
a liquid state the odorants now have an

27  
00:00:56,549 --> 00:00:54,559  
opportunity to release

28  
00:00:59,510 --> 00:00:56,559  
so how long does it take to diffuse

29  
00:01:00,950 --> 00:00:59,520  
through the wax it's not applicable

30  
00:01:03,270 --> 00:01:00,960  
it doesn't apply

31  
00:01:05,030 --> 00:01:03,280  
we're dealing with a solid so

32  
00:01:07,510 --> 00:01:05,040  
reasonably you could say it might take

33  
00:01:09,750 --> 00:01:07,520  
minutes under certain circumstances it

34  
00:01:11,429 --> 00:01:09,760  
might take hours there's literature

35  
00:01:12,630 --> 00:01:11,439  
saying that the pheromone sits for an

36  
00:01:14,710 --> 00:01:12,640  
hour and a half on the outside of the

37  
00:01:16,310 --> 00:01:14,720  
insects in cilla this would seem to be

38  
00:01:18,469 --> 00:01:16,320

supported by the physical evidence right

39

00:01:20,149 --> 00:01:18,479

now and so this might take minutes to

40

00:01:23,109 --> 00:01:20,159

hours some of you might be saying well

41

00:01:24,630 --> 00:01:23,119

your presentation's over tom you're done

42

00:01:26,070 --> 00:01:24,640

your goal of one to ten milliseconds has

43

00:01:27,670 --> 00:01:26,080

been completely blown out of the water

44

00:01:28,950 --> 00:01:27,680

right now so why don't you just sit down

45

00:01:30,870 --> 00:01:28,960

however you can see i've got some other

46

00:01:33,350 --> 00:01:30,880

steps to go and york hasn't told me to

47

00:01:35,030 --> 00:01:33,360

sit down yet

48

00:01:37,270 --> 00:01:35,040

so what's our next step the next step is

49

00:01:38,710 --> 00:01:37,280

time to diffuse through the pores well

50

00:01:40,630 --> 00:01:38,720

it has to diffuse through the pores but

51  
00:01:42,390 --> 00:01:40,640  
has to get to the pores

52  
00:01:45,990 --> 00:01:42,400  
this is a representative syncilla

53  
00:01:48,149 --> 00:01:46,000  
trichodia from bombix mori the silkworm

54  
00:01:50,389 --> 00:01:48,159  
can you see the pores

55  
00:01:51,190 --> 00:01:50,399  
maybe not let me point them out to you

56  
00:01:54,710 --> 00:01:51,200  
one

57  
00:01:56,389 --> 00:01:54,720  
two three four this is drawn to scale

58  
00:01:58,469 --> 00:01:56,399  
this is drawn to scale so when the

59  
00:02:01,429 --> 00:01:58,479  
pheromone hits

60  
00:02:04,069 --> 00:02:01,439  
the syncilla tricodia most of them get

61  
00:02:06,630 --> 00:02:04,079  
stuck on the outside most of them don't

62  
00:02:08,389 --> 00:02:06,640  
go inside the pores and therefore most

63  
00:02:11,430 --> 00:02:08,399

of them are going to have to migrate in

64

00:02:13,270 --> 00:02:11,440

some way through a solid crystalline

65

00:02:15,510 --> 00:02:13,280

waxy layer

66

00:02:17,510 --> 00:02:15,520

borderline impossible

67

00:02:19,270 --> 00:02:17,520

and so time to diffuse through the pores

68

00:02:21,190 --> 00:02:19,280

unknown no one's ever actually looked at

69

00:02:23,030 --> 00:02:21,200

anything like that before what about the

70

00:02:24,949 --> 00:02:23,040

time to bind a pheromone what's the

71

00:02:26,470 --> 00:02:24,959

process there well fortunately this has

72

00:02:29,430 --> 00:02:26,480

been looked at a little bit more the

73

00:02:31,270 --> 00:02:29,440

pheromone binding protein binds uh very

74

00:02:32,390 --> 00:02:31,280

well to the pheromone you put the

75

00:02:34,309 --> 00:02:32,400

pheromone binding protein and the

76  
00:02:35,270 --> 00:02:34,319  
pheromone together and they will become

77  
00:02:37,589 --> 00:02:35,280  
a couple

78  
00:02:39,430 --> 00:02:37,599  
like that so that's not a problem at all

79  
00:02:41,350 --> 00:02:39,440  
that'll turn about one millisecond so

80  
00:02:43,509 --> 00:02:41,360  
we're doing pretty good there

81  
00:02:44,949 --> 00:02:43,519  
time to transport the pheromone now

82  
00:02:46,309 --> 00:02:44,959  
remember it's not the pheromone that i'm

83  
00:02:47,910 --> 00:02:46,319  
transporting

84  
00:02:50,390 --> 00:02:47,920  
it's the pheromone and the pheromone

85  
00:02:51,990 --> 00:02:50,400  
binding protein because it's a complex

86  
00:02:54,630 --> 00:02:52,000  
and because it's a complex that's a big

87  
00:02:56,790 --> 00:02:54,640  
molecule the bigger the molecule the

88  
00:02:58,390 --> 00:02:56,800

slower the diffusion so that's what i'm

89

00:02:59,270 --> 00:02:58,400

going to have to transport to the other

90

00:03:01,589 --> 00:02:59,280

side

91

00:03:03,670 --> 00:03:01,599

so i hit the literature 1993 broon and

92

00:03:05,190 --> 00:03:03,680

kim have a nice

93

00:03:07,190 --> 00:03:05,200

article that i can look at and make some

94

00:03:09,589 --> 00:03:07,200

extrapolations from predicting protein

95

00:03:11,270 --> 00:03:09,599

diffusion coefficients for those of you

96

00:03:13,030 --> 00:03:11,280

who may not be aware of this you have

97

00:03:15,270 --> 00:03:13,040

two different diffusion coefficients one

98

00:03:16,550 --> 00:03:15,280

is an air theater's in water so i'm

99

00:03:17,990 --> 00:03:16,560

interested in the one in water because

100

00:03:20,790 --> 00:03:18,000

that mostly closely resembles what i'm

101  
00:03:22,390 --> 00:03:20,800  
looking for so i take a look is it a rod

102  
00:03:24,149 --> 00:03:22,400  
or is it a globular protein mine's a

103  
00:03:26,790 --> 00:03:24,159  
globular protein it's about 14

104  
00:03:28,710 --> 00:03:26,800  
kilodaltons diffuses across my syncillar

105  
00:03:30,070 --> 00:03:28,720  
space i find out according to the

106  
00:03:33,350 --> 00:03:30,080  
literature it's going to take about 10

107  
00:03:34,789 --> 00:03:33,360  
to 12 milliseconds for that complex to

108  
00:03:36,070 --> 00:03:34,799  
make it across that space to the

109  
00:03:38,070 --> 00:03:36,080  
dendrite

110  
00:03:39,670 --> 00:03:38,080  
and boy did i make some big mistakes

111  
00:03:41,910 --> 00:03:39,680  
right now let me point them out to you

112  
00:03:43,190 --> 00:03:41,920  
for those of you who are not aware these

113  
00:03:45,990 --> 00:03:43,200

are some of the mistakes i made some

114

00:03:47,750 --> 00:03:46,000

invalid assumptions with that one can i

115

00:03:49,509 --> 00:03:47,760

make a linear extrapolation the

116

00:03:51,430 --> 00:03:49,519

diffusion is a two dimensional molecule

117

00:03:53,670 --> 00:03:51,440

can i uh make a linear extrapolation to

118

00:03:55,589 --> 00:03:53,680

three no

119

00:03:56,789 --> 00:03:55,599

that there is a diffusion gradient i'm

120

00:03:58,149 --> 00:03:56,799

assuming that there's a diffusion

121

00:04:00,070 --> 00:03:58,159

gradient and there is not a diffusion

122

00:04:01,910 --> 00:04:00,080

gradient there is a much higher amount

123

00:04:03,750 --> 00:04:01,920

inside than there is outside so that's

124

00:04:05,509 --> 00:04:03,760

blown out of the water i'm assuming that

125

00:04:07,670 --> 00:04:05,519

there's a pure water solvent that's not

126

00:04:09,509 --> 00:04:07,680

pure water there's a lot of stuff in

127

00:04:11,670 --> 00:04:09,519

there and it is not pure water and

128

00:04:14,149 --> 00:04:11,680

therefore it becomes more like a gel as

129

00:04:16,069 --> 00:04:14,159

that individual last month told me about

130

00:04:18,069 --> 00:04:16,079

two i assume that no bound water

131

00:04:21,430 --> 00:04:18,079

molecules occur to the pbp or the

132

00:04:23,110 --> 00:04:21,440

pheromone binding protein well they do

133

00:04:24,790 --> 00:04:23,120

i assume that there's no dendritic

134

00:04:26,870 --> 00:04:24,800

sheath yes there's actually a sheath

135

00:04:28,070 --> 00:04:26,880

surrounding the dendrites that's also a

136

00:04:29,350 --> 00:04:28,080

problem how does the pheromone and the

137

00:04:31,270 --> 00:04:29,360

pheromone bonding protein get through

138

00:04:32,950 --> 00:04:31,280

that and i'm assuming that there's no

139

00:04:37,189 --> 00:04:32,960

change in temperature or viscosity over

140

00:04:38,629 --> 00:04:37,199

time all invalid assumptions

141

00:04:40,550 --> 00:04:38,639

so because i can't make this assumption

142

00:04:42,230 --> 00:04:40,560

why am i making this assumption at all

143

00:04:44,070 --> 00:04:42,240

well all i have to work with right now

144

00:04:46,629 --> 00:04:44,080

is 10 to 12 milliseconds there's no way

145

00:04:47,830 --> 00:04:46,639

to work with anything else so

146

00:04:49,270 --> 00:04:47,840

i'm just going to tell you right now the

147

00:04:52,469 --> 00:04:49,280

time to transport the pheromone is going

148

00:04:55,189 --> 00:04:52,479

to be a minimum of 10 milliseconds

149

00:04:57,030 --> 00:04:55,199

it doesn't matter to me i don't care

150

00:04:58,469 --> 00:04:57,040

whether or not it actually takes 11

151

00:05:04,070 --> 00:04:58,479  
milliseconds

152

00:05:06,230 --> 00:05:04,080  
i care about is that it's not faster

153

00:05:09,590 --> 00:05:06,240  
than 10 milliseconds right now and that

154

00:05:11,830 --> 00:05:09,600  
i can make with some certainty

155

00:05:13,749 --> 00:05:11,840  
so uh the time to dissociate from the

156

00:05:15,990 --> 00:05:13,759  
pheromone what about this has this been

157

00:05:17,430 --> 00:05:16,000  
looked at fortunately it has

158

00:05:19,749 --> 00:05:17,440  
time to dissociate from the pheromone

159

00:05:21,749 --> 00:05:19,759  
how does this happen well uh we do know

160

00:05:23,749 --> 00:05:21,759  
that it can dissociate but there are

161

00:05:24,790 --> 00:05:23,759  
some problems as you might imagine

162

00:05:26,550 --> 00:05:24,800  
there's been problems throughout my

163

00:05:28,390 --> 00:05:26,560

entire talk here's some more

164

00:05:30,310 --> 00:05:28,400

the problem is this once the pheromone

165

00:05:34,469 --> 00:05:30,320

binds with a pheromone binding protein

166

00:05:40,390 --> 00:05:37,990

it migrates across simple to understand

167

00:05:42,310 --> 00:05:40,400

and it binds to the purported receptor

168

00:05:44,390 --> 00:05:42,320

now it must associate well how does it

169

00:05:48,310 --> 00:05:44,400

do that

170

00:05:49,749 --> 00:05:48,320

dissociation only occurs at a ph of five

171

00:05:51,510 --> 00:05:49,759

there is no separation between the

172

00:05:54,710 --> 00:05:51,520

pheromone and the pheromone protein it

173

00:05:56,150 --> 00:05:54,720

binds strongly it binds so strongly that

174

00:05:57,270 --> 00:05:56,160

the germans carl casein that i talked

175

00:05:58,710 --> 00:05:57,280

about right now feels that it doesn't

176

00:06:00,230 --> 00:05:58,720

dissociate at all

177

00:06:02,230 --> 00:06:00,240

he actually feels the whole thing as a

178

00:06:04,629 --> 00:06:02,240

complex gets there because it really

179

00:06:06,950 --> 00:06:04,639

cannot dissociate however walter liel

180

00:06:10,550 --> 00:06:06,960

california ph of 5. this is how it

181

00:06:11,909 --> 00:06:10,560

separates well where is a ph of 5.

182

00:06:13,670 --> 00:06:11,919

does anyone have a ph of 5 running

183

00:06:15,270 --> 00:06:13,680

through their blood i hope not

184

00:06:17,590 --> 00:06:15,280

because you're not healthy

185

00:06:18,550 --> 00:06:17,600

so where's the physiological ph the ph

186

00:06:21,670 --> 00:06:18,560

of 5

187

00:06:23,590 --> 00:06:21,680

is located right here along the membrane

188

00:06:24,870 --> 00:06:23,600

so you must have contact with the

189

00:06:27,110 --> 00:06:24,880

membrane

190

00:06:30,070 --> 00:06:27,120

then the molecule recognizes it as being

191

00:06:32,309 --> 00:06:30,080

in a ph of 5 environment okay

192

00:06:34,390 --> 00:06:32,319

and then dissociation occurs and then it

193

00:06:35,749 --> 00:06:34,400

makes its way to the receptor

194

00:06:37,350 --> 00:06:35,759

well this is a little difficult to

195

00:06:39,670 --> 00:06:37,360

swallow but this is what's being

196

00:06:42,950 --> 00:06:39,680

reported right now

197

00:06:44,390 --> 00:06:42,960

and this occurs in nine milliseconds

198

00:06:46,710 --> 00:06:44,400

if

199

00:06:49,670 --> 00:06:46,720

we have a ph of five

200

00:06:51,990 --> 00:06:49,680

if we don't have a ph of five

201  
00:06:54,629 --> 00:06:52,000  
the half-life of dissociation is about

202  
00:06:55,670 --> 00:06:54,639  
100 seconds not milliseconds

203  
00:06:57,430 --> 00:06:55,680  
seconds

204  
00:06:59,270 --> 00:06:57,440  
this will not separate

205  
00:07:01,430 --> 00:06:59,280  
so do i go with the nine millisecond

206  
00:07:02,469 --> 00:07:01,440  
figure doesn't really matter as you can

207  
00:07:05,990 --> 00:07:02,479  
see right now

208  
00:07:08,070 --> 00:07:06,000  
or do i go with 100 second figure

209  
00:07:09,990 --> 00:07:08,080  
that's your choice and time to activate

210  
00:07:11,350 --> 00:07:10,000  
the receptor well that doesn't take long

211  
00:07:13,510 --> 00:07:11,360  
at all probably on the order of about 50

212  
00:07:14,950 --> 00:07:13,520  
picoseconds receptors activate pretty

213  
00:07:17,270 --> 00:07:14,960

quickly so that's not really a major

214

00:07:19,110 --> 00:07:17,280

problem in the theory but we're dealing

215

00:07:21,990 --> 00:07:19,120

with something which is very very quick

216

00:07:26,950 --> 00:07:22,000

therefore significantly less than one

217

00:07:31,670 --> 00:07:29,430

and so some of you are not convinced

218

00:07:33,430 --> 00:07:31,680

why because you're the ssc

219

00:07:35,189 --> 00:07:33,440

because you're the ssc some of you are

220

00:07:36,469 --> 00:07:35,199

skeptical some of you are not buying

221

00:07:38,710 --> 00:07:36,479

what i'm telling you right now some of

222

00:07:39,830 --> 00:07:38,720

you are convinced thank you some of you

223

00:07:41,430 --> 00:07:39,840

are not

224

00:07:43,830 --> 00:07:41,440

but you're you might be a normal

225

00:07:45,189 --> 00:07:43,840

run-of-the-mill skeptic and that's fine

226

00:07:47,029 --> 00:07:45,199

some of you might be a pathological

227

00:07:48,150 --> 00:07:47,039

skeptic and i can't do anything for you

228

00:07:50,469 --> 00:07:48,160

but for you

229

00:07:52,950 --> 00:07:50,479

normal everyday run-of-the-mill skeptics

230

00:07:54,869 --> 00:07:52,960

right now i want you to chew on this

231

00:07:57,029 --> 00:07:54,879

take a look at neural transmitter

232

00:07:59,270 --> 00:07:57,039

synaptic transmission let's take a look

233

00:08:00,710 --> 00:07:59,280

and find out how long this process takes

234

00:08:03,110 --> 00:08:00,720

a process which has been known for

235

00:08:04,550 --> 00:08:03,120

decades and is exactly the same process

236

00:08:07,350 --> 00:08:04,560

that is being talked about in the

237

00:08:11,749 --> 00:08:09,350

one there's a major difference between

238

00:08:12,869 --> 00:08:11,759

the two the synapse the acetylcholine

239

00:08:14,469 --> 00:08:12,879

synapse that i'm talking about there's

240

00:08:16,550 --> 00:08:14,479

type 1 and type 2 receptors i'm talking

241

00:08:18,710 --> 00:08:16,560

about the one that's 20 nanometers long

242

00:08:21,589 --> 00:08:18,720

is going to diffuse over the course of

243

00:08:23,909 --> 00:08:21,599

20 nanometers my insect

244

00:08:27,270 --> 00:08:23,919

is diffusing over the course of between

245

00:08:29,670 --> 00:08:27,280

1150 to two thousand nanometers close

246

00:08:31,909 --> 00:08:29,680

one to two micrometers

247

00:08:33,110 --> 00:08:31,919

well that's a huge difference right now

248

00:08:34,230 --> 00:08:33,120

that would seem to make a difference

249

00:08:36,149 --> 00:08:34,240

right there but let's take a look at the

250

00:08:38,149 --> 00:08:36,159

time course of events arrival of the

251  
00:08:40,310 --> 00:08:38,159  
excitatory impulse again we'll assign

252  
00:08:41,750 --> 00:08:40,320  
that at zero milliseconds

253  
00:08:44,070 --> 00:08:41,760  
the binding of the vesicle to the

254  
00:08:46,150 --> 00:08:44,080  
membrane and release of neurotransmitter

255  
00:08:48,550 --> 00:08:46,160  
we have got it down to between three to

256  
00:08:50,230 --> 00:08:48,560  
five milliseconds right now so it's not

257  
00:08:51,990 --> 00:08:50,240  
faster than three and it's certainly not

258  
00:08:53,430 --> 00:08:52,000  
lower than five i think that the

259  
00:08:54,389 --> 00:08:53,440  
resolution might be worked out a little

260  
00:08:56,310 --> 00:08:54,399  
bit better and there may be some

261  
00:08:57,750 --> 00:08:56,320  
neurophysiologists who know more about

262  
00:08:59,590 --> 00:08:57,760  
this than i do but we're at three to

263  
00:09:02,310 --> 00:08:59,600

five milliseconds right now

264

00:09:04,470 --> 00:09:02,320

diffusion across the synaptic cleft the

265

00:09:05,990 --> 00:09:04,480

20 nanometers and the binding of the

266

00:09:08,070 --> 00:09:06,000

neurotransmitter to the receptor they

267

00:09:10,949 --> 00:09:08,080

have not been able to separate all

268

00:09:12,230 --> 00:09:10,959

together that's 0.3 milliseconds take

269

00:09:16,150 --> 00:09:12,240

home message

270

00:09:17,990 --> 00:09:16,160

it takes 3.3 to 5.3 milliseconds for

271

00:09:19,430 --> 00:09:18,000

synaptic transmission

272

00:09:22,230 --> 00:09:19,440

and you're telling me

273

00:09:24,630 --> 00:09:22,240

that an insect is smelling as fast as

274

00:09:25,750 --> 00:09:24,640

synaptic transmission

275

00:09:30,070 --> 00:09:25,760

no

276

00:09:31,750 --> 00:09:30,080

so one of my conclusions well i think my

277

00:09:33,430 --> 00:09:31,760

conclusion should be obvious either the

278

00:09:34,870 --> 00:09:33,440

current theory of insectal faction needs

279

00:09:36,470 --> 00:09:34,880

to be modified

280

00:09:39,030 --> 00:09:36,480

in order to include one or more

281

00:09:40,550 --> 00:09:39,040

mechanisms in addition to simple

282

00:09:43,190 --> 00:09:40,560

diffusion because that's all i've got to

283

00:09:44,710 --> 00:09:43,200

work with right now simple diffusion or

284

00:09:46,750 --> 00:09:44,720

current theory needs to be replaced by a

285

00:09:49,430 --> 00:09:46,760

new theory that supports the

286

00:09:50,470 --> 00:09:49,440

electrophysiological or temporal

287

00:09:51,990 --> 00:09:50,480

data