Molecule Numbers at Insect Olfactory Threshold

		dimension	Bombyx ♂		Drone			Locusta	
sensillum			S. trichodeum		S. placodeum		S. coeloconicum		
odorous compound			Bombykol		Queen Substance	caproic acid	CO_2	hexenal	caproic acid
test method			behavior	EAG and single cell	single cell				
source (µg of odorous compound)			$1 \cdot 10^{-4}$	$1 \cdot 10^{-2}$	$1 \cdot 10^{-1}$	$5 \cdot 10^{-1}$	0,1%	$4 \cdot 10^{-4}$	$5 \cdot 10^{-3}$
molecule counting method: weight loss			+	+				+	+
molecule counting method: radioactive						+			+
molecule counting method: physiology			+	+	+				
log_{10} extrapolation from counted number			3	1	1	0	0	6	1
No. of molecules leaving source per second	A	$^1/_{sec}$	$7 \cdot 10^6$	$7 \cdot 10^8$	$9 \cdot 10^9$	$2 \cdot 10^{14}$	$8 \cdot 10^{18}$	$2 \cdot 10^{10}$	$4 \cdot 10^{11}$
cross sectional area of air current at antenna	B	mm^2	$4 \cdot 10^4$	28	28	28	28	28	28
air volume / sec	C	$^l/_{sec}$	40	0,05	0,10	0,10	0,3	0,14	0,14
molecular velocity (0° C)	D	$^m/_{sec}$	155	155	177	223	362	242	223
outline area of antenna	E	mm^2	6	6	1,1				
total surface area of antenna (incl. hairs etc.)	F	mm^2	36	36	$E \cdot \pi$	$\frac{F}{E} = \pi$	$\frac{F}{E} = \pi$	$\frac{F}{E} = \pi$	$\frac{F}{E} = \pi$
No. of sensilla	G		$1 \cdot 10^4$	$1 \cdot 10^4$	$1 \cdot 10^4$	$1 \cdot 10^4$	200	$1 \cdot 10^3$	$1 \cdot 10^3$
No. of receptor cells per sensillum	H		(1)-2	(1)-2	16	16	1	4 (-5)	4 (-5)
No. of specialized cells per sensillum	I		(1)-2	(1)-2	>2	>2	1	1	1
No. of sensory pores per sensillum	J		3200	3200	3800	3800	?	?	?
area of sensory pores per sensillum	K	μ^2	0,53	0,53	0,66	0,66	?	Melanoplus 0,13	0,13
area of sensory pores per cell	$\frac{K}{H}$	μ^2	0,27	0,27	0,04	0,04	?	0,03	0,03
No. of molecules / cm^3	$\frac{A}{C}$	$\frac{1}{cm^3}$	$2 \cdot 10^2$	$1 \cdot 10^7$	$9 \cdot 10^7$	$2 \cdot 10^{12}$	$3 \cdot 10^{16}$	$1 \cdot 10^8$	$3 \cdot 10^9$
No. of molecular strikes per μ^2 x second	$\frac{A \cdot D}{C \cdot 6}$	$\frac{1}{\mu^2 sec}$	$4 \cdot 10^{-3}$	$4 \cdot 10^2$	$3 \cdot 10^3$	$7 \cdot 10^7$	$2 \cdot 10^{12}$	$5 \cdot 10^3$	$1 \cdot 10^5$
No. of molecular strikes per second x receptor surface of 1 cell (no ads.)	$\frac{A \cdot D \cdot K}{C \cdot 6 \cdot H}$	$\frac{1}{sec}$	$1 \cdot 10^{-3}$	90	110	$3 \cdot 10^6$		170	$3 \cdot 10^3$
No. of molecular strikes against total antennal surface (no adsorption)	$\frac{D \cdot F \cdot B}{C \cdot 6 \cdot E}$		160	90	27	34	19	26	24
No. of molecules per sec x receptor surface of 1 cell (adsorption with 1st strike)	$\frac{A \cdot E \cdot K}{B \cdot F \cdot H}$	$\frac{1}{sec}$	$7 \cdot 10^{-6}$	1	4	$9 \cdot 10^4$		7	140

FIGURE 14. Olfactory threshold calculations for *Bombyx*, drone and locust. Morphological data for Bombyx from Steinbrecht (unpubl.), for the bee from Richards (1952), and for *Melanoplus* from Slifer, Prestage, and Beams (1959). A detailed description of the experimental procedures and the evaluation of data will be given elsewhere. The value (DFB): (C6E) represents the strikes of a single molecule (see second line from bottom).