Bioinformatics and molecular–based identification of odorant binding proteins in the malaria vector, *Anopheles gambiae*

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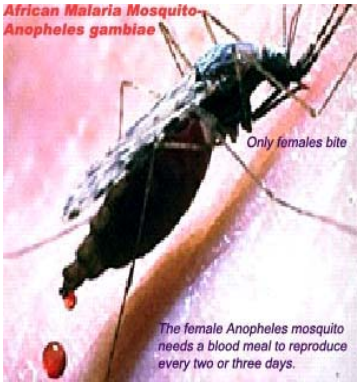


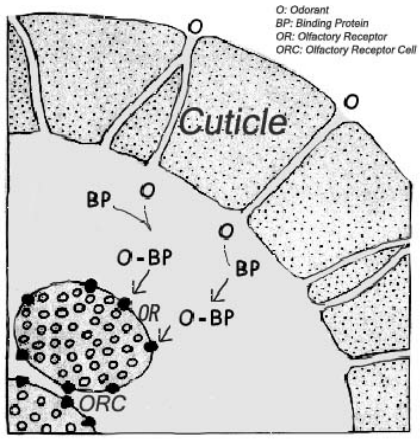
Malaria kills a child every 30 seconds. In Africa, 2,700 children die each day.

Introduction

*** The African malaria mosquito, *Anopheles gambiae* transmits *Plasmodium* spp., causing malaria and is especially dangerous owing to its dramatic tendency to feed on humans (anthropophily).**

*** Host-seeking and selection of the mosquitoes are mediated by host odours. Because of the importance of host preference in establishing the overall vectorial capacity, a molecular analysis of mosquito olfaction may provide opportunities for reducing the incidence of disease transmission. But for the first step, the components of the olfactory signal transduction cascade in *A. gambiae* must be identified. Ultimately, the design of novel methods of disrupting vector-host interactions is possible. This work reports the identification of odorant-binding proteins (OBP) of *A. gambiae*.**

Olfactory Signal Transduction



Screening the whole *Anopheles gambiae* genome sequence for OBPs

OBP family members are identifiable by four or six conserved Cys residues [OBP motif: Cx(n)Cx(3)Cx(n)Cx(n)Cx(8)C]. Search the whole genome sequences of *A. gambiae* with such motif we identified 30 putative genes coding mosquito OBPs, and they were further characterised by their signal peptides, secondary structure and biochemical properties. The figure and table show the alignment (example) and biochemical properties of these OBPs.

Celera ID	Length (aa)	Motifs and Spacing	Signal peptide	M.W. (KDa)	Isoelectric Points	Hydrophobic a.a.(%)
agCP9988	118	13 C 30 C 27 C LVA C 38 C 7 C DIAYAYYE C	1 - 24	13.4	4.7	33.9
agCP3071	122	18 C 28 C 26 C YVA C 39 C 10 C EVAYILLK C	1 - 29	13.8	7.7	31.2
agCP10852	118	12 C 28 C 28 C FLR C 38 C 9 C ETAFRAVE C	1 - 16	13.3	5.9	34.8
agCP12865	124	21 C 31 C 26 C YMN C 37 C 8 C EKAFWLNK C	1 - 29	14.7	5.3	29.8
agCP15554	183	13 C 31 C 26 C YMN C 37 C 8 C DKAFWLNK C	1 - 19	21.8	6.6	31.7
agCP2602	134	24 C 31 C 27 C YMG C 37 C 8 C ERAFWFMK C	1 - 25	15.2	8.3	30.6
agCP2622	125	13 C 31 C 26 C YMN C 37 C 8 C DKAFWLNK C	1 - 19	14.5	5.4	28.8
agCP1564	126	18 C 24 C 27 C FVK C 38 C 7 C ELKADIMK C	1 - 23	13.8	4.7	30.2
agCP5478	158	27 C 27 C 15 C TLE C 39 C 29 C LMKHTQAK C	1 - 23	18.1	5.2	21.6
agCP3788	172	32 C 27 C 21 C IAE C 42 C 36 C MDMMFAQ C	1 - 28	19.8	4.8	26.2
agCP9688	134	18 C 24 C 27 C FVK C 38 C 7 C DTAYQMYK C	1 - 23	15.2	9.1	32.8
agCP5421	134	18 C 24 C 27 C FVK C 38 C 7 C DTAYQMYK C	1 - 23	15.2	9.1	32.8
agCP11827	132	17 C 24 C 13 C YAM C 63 C 10 C DKAYFSAK C	1 - 25	15.0	8.2	28.0
agCP5479	149	26 C 27 C 17 C SLV C 40 C 27 C LMHSSMNK C	1 - 24	16.8	4.5	30.2
agCP1588	140	35 C 26 C 29 C FIK C 33 C 8 C EQAYFYIK C	1 - 34	15.4	4.5	33.6
agCP12864	126	1 C 45 C 26 C YIH C 38 C 8 C ETAYETVK C	1 - 28	14.2	5.1	37.3
agCP7462	115	29 C 17 C 26 C VHK C 40 C 12 CEKAYLLLNQ C	1 - 27	12.3	7.7	33.9
agCP7476	276	37 C 26 C LLK C 38 C 12 C TQVYKAFQ C	1 - 20	31.6	5.2	32.3
agCP7463	276	37 C 26 C LLK C 38 C 12 C TQVYKAFQ C	1 - 20	31.6	5.2	32.3
ebi29163	125	27 C 27 C YHY C 37 C 10 C EKAYSHHK C	No	14.2	5.9	28.8
agCP14889	138	28 C 26 C FVR C 38 C 11 C EAAYRQEL C	1 - 28	14.9	4.8	31.5
agCP11895	173	47 C 26 C FLR C 38 C 13 C TAAYRQEL C	No	19.9	6.3	34.1
agCP15810	115	11 C 26 C YVN C 40 C 10 C DAAYVLLQ C	No	12.8	8.5	32.2
agCP7476	257	40 C 26 C LVL C 37 C 12 C VQAYRAFQ C	1 - 20	29.6	5.8	30.7
agCP9973	113	33 C 27 C FAK C 38 C 7 C ETAFKAYQ C	1 - 18	12.2	8.2	33.6
agCP5335	121	17 C 26 C YVS C 40 C 10 C EAKAILLQ C	No	13.7	8.9	34.7
agCP12497	121	17 C 26 C YVS C 40 C 10 C EAKAILLQ C	No	13.7	8.9	33.9
agCP7381	118	22 C 29 C 18 C EVAYILLK C	1 - 33	12.6	7.8	29.2
agCP3694	138	5 C MSE C 43 C 38 C IHTVFSD C	No	14.6	8.2	29.2
agCP12619	115	19 C 62 C 7 C DIAYAYYD C	1 - 23	13.1	7.7	31.3

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consensus     1 LEECKEESGLTDAVIEEFFDGYEFEDRELGCAIACLSKKLELLDDDGKLHHENAIEFAKHGNDDAMHGCTEDDPCDRALEVAKCFKKEIHK 132
query        13 HDICLGKTGVTEEAIKKFSDEEIHEDEKLKCYMNCLFHEAKVVDDNGDVHLEKLHDSLPSMHDIAMKRCLYETLCDKAFWLHKCWKQSDPK 139
gi 2444187   13 IKLCQQELGADDSVVKEFLDGYVMKDRQTGCMLICMAMKLELLDSAMEIHHGSTFAFAKHGADEAMHGCTYNDPCQRAVNVAMCFKAHVHK 146
gi 1709595   16 ANECKAETGATDEDVEQLMSHDLPERHEAKCLRACVMKKLQIMDESGKLNKEHAIELVKSKHDAEKAKCIEEDHCDAAFAYEECIYEQMRE 142
gi 1709596   26 HDACVEKTGVTEAAIKEFSDGEIHEDEKLKCYMNCFFHEIEVVDDNGDVHLEKLFATVPLSMRDKLKGCPEDTLCHKAWWFHQCWKKADPK 149
gi 2494874    9 HDICAPKTGVTDEAIKEFSDGQIHEDEALKCYMNCLFHEFEVVDDNGDVHMEKVLNAIPEKLRNIMKGCPEDTLCHKAWWFHQCWKKADPV 136
gi 2494876    1 SAECKTESGASEAVIKKARKGDLEDDPKLKMQLLCIFKALEIVAESGEIEADTFKEKLTVTNDDEEEKCTEDTPEDTAFEVTKCVLKDKPN 121
gi 2494869   13 LEDCKKEMDLPDSVTTDFYEGYEFTNRHTGCASLCLSSKLELLDQEMKLHHGKAQEFAKHGADDAMHGCSTDDPCMKALNVAKCFKAKIHE 145
gi 1255915   15 MDQCKQELNLPDSVIADLYDDYVMTDRLAGCAINCLSTKLDIVDPDGNLHHGNAKEFAMHGADDGMHGCSSDDKCIKTMDIAMCFKKEIHK 146
gi 2494872   12 LDKCREESQLTEEKMEEFFDDFKFEHRELGCAIQCMSRHFNLLTDSSRMHHDNTEKFIQFPNGEVLHSCQFEDHCWRISHLADCFKSSCVQ 143
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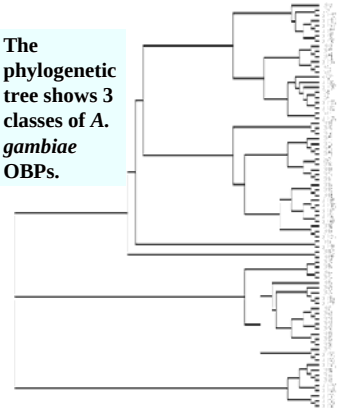
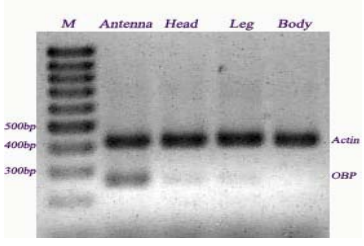
Phylogenetic analysis

The phylogenetic tree shows 3 classes of *A. gambiae* OBPs.

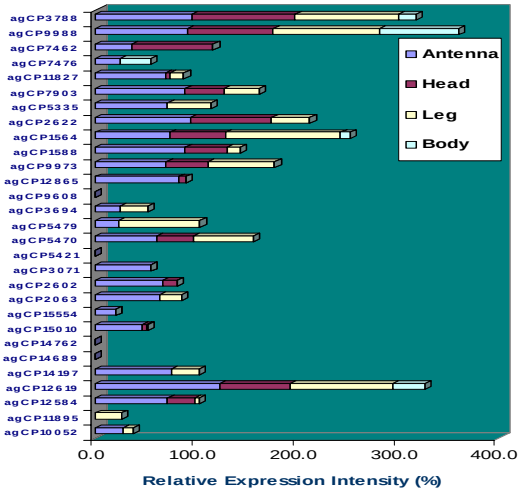


Tissue-specific expression pattern verified by semi-quantitative RT-PCR



Example of semi-quantitative RT-PCR.

The figure shows the female antenna-specific expression of OBP (Actin was used as the internal standard).



The graph indicates that some of the candidates are antenna-specific, which may play a major role in mosquito olfactory signal transduction.

Acknowledgements

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