

Instructor's Notes

This activity allows students to work through the process of identifying the molecular basis of insecticide resistance in mosquitoes. They essentially “discover” the results of a paper published in 2003 (see file #10 for copy of the original paper).

The SR and SLA-B sequences used for this exercise were obtained in 2003 directly from the authors of the Nature article on which the activity is based. As we worked through the data, we discovered some discrepancies with the published paper. When we communicated with M. Weill, she indicated that they, too, had identified the typos – and some additional errors in the nucleotide sequences. The nucleotide sequences for SLA-B (AJ489456) and SR (AJ515147) were published in 2005. The paper addresses 27 nucleotide differences; we found 28 in the sequences provided by the authors, and there are 35 differences between the corrected, published sequences.

Interestingly, when the revised sequences are translated and aligned, there are two differences in the protein sequences. The second variation does not lie in the same exon. When the authors compared AChE cDNA sequences from a wide range of mosquitoes, they used PCR to amplify only the exon (labeled 3 in the paper, but 5 in the sequences deposited in NCBI) in which the original G119S change had been identified, so it is difficult to determine if the second difference contributes to insecticide resistance. However, additional experiments in the paper support the claim that the G119S change is sufficient to result in insecticide resistance.

We chose to use the uncorrected data so students could compare their findings with the published paper. (They should be able to identify the typos in the paper.) You may wish to introduce the corrected, published data to promote a discussion about the iterative process of science.

Students should be given EITHER file 2 or file 3 (depending on focus) and files 4-5.

Files for this activity:

1. Instructor's Notes (this document)
2. AChE student worksheet – Zika
3. AChE student worksheet – West Nile Virus
4. DataFile1
5. DataFile2
6. AChE nucleotide sequence links – *links to corrected, published data*
7. DNA alignment – *copy of results*
8. DNA multisequence alignment – *copy of results*
9. Cladogram – *copy of results*
10. Weill, 2003 Nature and sup. – *original paper and supplemental data*