

# Accurate incorporation of somatic recombination in a hands-on activity that demonstrates the central dogma of molecular biology

Sophia D. Sarafova<sup>1</sup>

**AUTHOR AFFILIATION** See affiliation list on p. 2.

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I have read the Tips and Tools article “A Hands-On Activity to Demonstrate the Central Dogma of Molecular Biology Via a Simulated VDJ Recombination Activity” (1) and as I value hands-on activities in teaching, I attempted to implement it in my undergraduate immunology class. My students and I had a great learning outcome but not in the way we expected. In the process of performing the exercise we discovered some critical deviations from the currently established understanding of the process of VDJ recombination as described in Janeway’s Immunobiology (2) or Kuby Immunology (3) textbooks and in the manuscript’s Fig. 1. Specifically, the instructions for folding the paper model (step 4 in the manuscript and step 3 in the appendix materials) and the expected results (Fig. 2D and E) do not produce a single exon after recombination as they are supposed to. That creates two problems—one, a splicing event now needs to be added between V and J segments, which does not normally occur (Fig. 2E), and two, a mechanism of adding diversity to the coding joint, namely P-nucleotide addition, is no longer possible. If the exercise wishes to illustrate only combinatorial diversity, that can be done by stipulating that in this example there is no P-nucleotide addition, solving the second problem. However, the first problem remains unresolved and will require revision of both the instructions and Fig. 2D and E to become accurate. I suggest that the student instructions should have the following changes (quoted from the paper with changes in bold): “4. Now fold your paper chromosome (Fig. 2C) to bring your chosen L/V **flush against** the chosen J region, as in 2D.” and “6. Notice that your new recombination product has both introns and exons **with the chosen V and J making a single exon after recombination** Insert splice junctions between the L and V you chose **and between** the J you chose and the C. Notice that you **will** be skipping **any remaining J regions that are not a part of the newly recombined V/J exon**, as in 2E.” I am providing a revised version of Fig. 2D and E that match the revised instructions, as well as Fig. 3, which illustrates potential outcomes of the exercise (Fig. 1). Instructors wishing to use this revised version, should make sure to transfer the changes to the various handouts provided in the Supplemental Materials of the paper. The exercise did solidify my students’ understanding of the process and I will continue to use it with the modifications I have suggested here.

**Editor** Stanley Maloy, San Diego State University, San Diego, California, USA

Address correspondence to Sophia D. Sarafova, sosarafova@davidson.edu.

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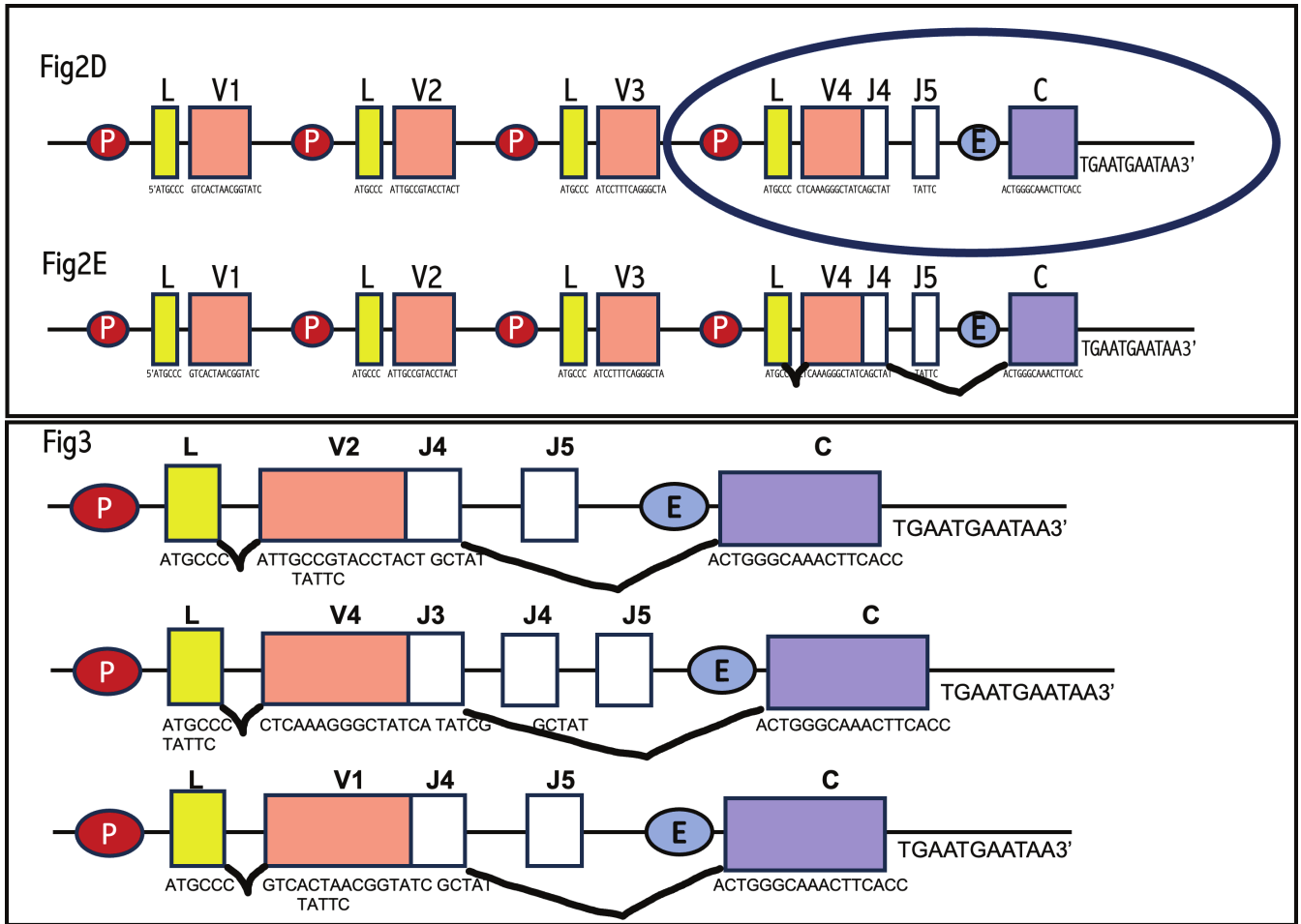


FIG 1 Revised figures from [Marshall (1); JMBE] to match the proposed corrections to the hands-on exercise.

**AUTHOR AFFILIATION**

<sup>1</sup>Biology Department, Davidson College, Davidson, North Carolina, USA

**AUTHOR ORCID**s

Sophia D. Sarafova <http://orcid.org/0009-0002-2337-506X>

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