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RE: Opponents' review for the bachelor thesis of Shehab Moukbel Ali Aldawla

I have co-supervised the bachelor thesis of Shehab Moukbel Ali Aldawla with the title "Calling haplotypes from duplex sequencing data and its applications: A case study with ERBB2 data". For his thesis, he developed several tools for studying and visualizing haplotypes in duplex sequencing data with the aim of identifying artifacts based on the haplotype quality and crossovers in recombination hotspots.

Shehab Moukbel Ali Aldawla first tested the developed tools on duplex sequencing data of the Erbb2 gene of two donors and as expected he observed that the number of formed haplotypes decreased by applying several filters to remove false positives and only high-quality haplotypes remained. Next, he extended his analysis to a larger number of donors and different experimental conditions. He compared so-called 'repaired' and 'non-repaired' samples in terms of haplotype lengths, genomic positions (exonic vs intronic), and substitution types. He showed that most of the haplotypes consisted only of two variants and were located in intronic regions of the gene. Additionally, the tools removed haplotypes that are less similar to the mutation spectra of the COSMIC and gnomAD database suggesting that these are false positive haplotypes. Moreover, he addressed the challenge of calling common haplotypes by the absence of missing sequence information. The newly developed tools in this thesis set the basis for future research in calling short tandem repeats (STRs) and recombinational crossovers.

Finally, Shehab Moukbel Ali Aldawla discussed his progress with Prof. Irene Tiemann-Boege throughout the semester. The thesis itself was well-written and structured in a scientifically sound manner. Therefore, I grade this thesis as excellent and assign it the grade "one".

A handwritten signature in black ink, reading 'Monika Heinzl'.

Monika Heinzl