Assoc. Prof. Dr.
Irene Tiemann-Boege
Institute of Biophysics
Johannes Kepler University

P +43 732 2468 7620
Irene.tiemann@jku.at

JOHANNES KEPLER
UNIVERSITY LINZ

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RE: Supervisor's review for the bachelor thesis of Fardokhtsadat Mohammadi

With great pleasure I supervised the bachelor work of Fardokhtsadat Mohammadi that was described in the bachelor thesis "*Fine-scale recombination maps of the cattle genome inferred by linkage disequilibrium*" required for her studies in Bioinformatics. Her worked involved the analysis of recombination with the LDJump program developed by Hermann et al (2019). For this purpose, Ms. Mohammadi had to make new modifications to LDJump to allow the direct import of *vcf* files (a common format of variant sequencing data) that shortened the run-times of the program, as well as allowing the easy use of LDJump, since *vcf* is a common format for sequencing files. In addition to implementing LDJump, she ran a series of analysis on selected regions with different parameters (e.g. high SNP density or low SNP density, inbreeding, etc).

Her work demonstrated her independence to solve difficult tasks regarding data handling and management. Specifically, she was provided *vcf* files from next-generation sequencing data of two different Austrian cattle breeds (Fleckvieh and Braunvieh) comprising 161 and 91 individuals. Ms. Mohammadi analyzed with LDJump the patterns of recombination in two regions of chromosome 25: one with a high and one with low SNP density. Moreover, she provided important insights as to how the levels of inbreeding modified the inferred recombination and tested LDJump under different demography assumptions. These analyses addressed the important question, if LD Jump can be implemented in species with high levels of inbreeding and strong population bottlenecks, as is the case for domestic breeds. Finally, during her project she showed the initiative to further explore biological aspects that influence recombination such as gene density, SNP frequency, and GC content, and implemented a series of statistical test to show a correlation.

Her thesis was extremely well-written and easy to read given its structured organization. Her analyses provide important preliminary data for further research in this area, as well as for project proposals. In my opinion this was an exceptionally good bachelor thesis that is far beyond the level of a bachelor thesis.

Irene Tiemann-Boege

JOHANNES KEPLER
UNIVERSITY LINZ
Gruberstrasse 44
4040 Linz, Austria
www.jku.at
DVR 0093696