Intellectual Merit Criterion

Overall Assessment of Intellectual Merit

Very Good

Explanation to Applicant

The current proposal which seeks to understand somatic mutations is a relevant topic. The hypotheses presented, including the variability of mutation rates with tissue type, are clear and reasonable. There is also a separate discussion of anticipated results which makes for a more thoroughly drafted proposal. However, a further analysis involving alternative paths, should the current experimental strategy fail or encounter unexpected difficulty was not evident in the proposal. Furthermore, the application does address a scenario in which the hypothesis is not supported. The candidate presented an eloquent case for a passionate pursuit of science. In addition, the applicant mentioned the development of learning apps that can be used to understand Drosophila development, though it was not clear from the description what role the applicant played in development of these tools. It is notable however, that additional relevant research experiences are cited by the applicant, presenting a strong research foundation for the candidate's proposal.

Broader Impacts Criterion

Overall Assessment of Broader Impacts

Excellent

Explanation to Applicant

The candidate presented some background in developing useful education tools. Further, the applicant argues for the broader importance of the findings from the proposal. A plan is presented for the dissemination of the research findings as well as for making the tools generated from the work publicly available Additional outreach efforts are also planned at the applicant's university. Together, these constitute a highly adequate Broader Impacts proposal

Summary Comments

This is a research proposal from a candidate with a strong background in data sciences and programming. The research proposal which involves understanding how somatic mutations affect different tissues, features two well developed hypothesis. However, important aspects of the experimental design are missing from the proposal. The Broader Impacts section is strong and including plans to freely disseminate the findings from the research project, and outreach efforts to secondary school students. Overall, this is an interesting proposal with a well-developed outreach plan.

Intellectual Merit Criterion

Overall Assessment of Intellectual Merit

Good

Explanation to Applicant

The applicant has an impressive academic and research-related background. He double-majored in Mathematics and Molecular Biology, and has spent most of his undergraduate studies involved in research at his university (training both computational, and molecular biology skills). His recommendation letters, support the view of a bright, engaged student with capacity to bridge both fields. The applicant proposes to study the occurrence of somatic mutations in a variety of mouse tissues. There are two main hypotheses. Preliminary work in another model system, to which he successfully contributed (leading to a poster presentation at an international event) provides reassurance that he will be successful in attaining hypothesis 1. However, the methods for Hypothesis 2 (relating mutations rates to transcriptional activity) seem a bit shaky. Here, the applicant proposes to infer

expression status of genomic regions based on interrogating the functional gene annotations (Gene Ontologies terms) in those regions with high somatic mutation rates. It is unclear on what basis the applicant can confidently ascribe GO terms to specific tissues as a measure for transcriptional activity. The most direct way to do this would be to employ transcriptomic evidence (either from existing studies, or by their own RNA-seq efforts). The proposal could thus be improved by explaining the approach of hypothesis 2 in more detail.

Broader Impacts Criterion

Overall Assessment of Broader Impacts
Excellent

Explanation to Applicant
Because the applicant has a strong interest in both computational and molecular biology, he is in a rare position to instruct computational skills in a way that is relevant for biology students and researchers. He has already successfully volunteered in such capacity through the non-profit organization 'Software Carpentry'. He also shows a broad commitment to service through student mentoring, organization of outreach activities, and the development of computational tools for educational purposes as part of his undergrad research (e.g. mobile apps). He included plans for training an undergraduate student as part of his research proposal and has made the plans to discuss his project at university and high school outreach events. If the applicant maintains his interests to make these kind of efforts, he will make a lasting impact on the education of computational methods and science outreach in general.

Summary Comments
This is an application of motivated, bright student who has shown his ability to excel in the field of his proposed research. He appears to be well prepared, but there appear to be some glitches in the proposal that could possibly have been circumvented through by adopting a more comprehensive scope of the proposed study goals and methods.

Intellectual Merit Criterion

Overall Assessment of Intellectual Merit
Excellent

Explanation to Applicant
The applicant has a broad background with undergraduate degrees in both mathematics and molecular biology. His grades and letters of recommendation are excellent. He has done research in several labs. This research has involved both computational and experimental work. His proposal is well-written and achievable, given his prior achievements and strong computational background. He proposes to look at the mutation rates in somatic cells taken from various mouse samples including epithelial, nervous, and muscle tissues. He hypothesizes that epithelial cells will have a faster mutation rate than others because they divide faster.

Broader Impacts Criterion

Overall Assessment of Broader Impacts
Excellent

Explanation to Applicant
The broader impacts of this application are also excellent. The applicant wants to write open source scientific software and has already done so. He has also been part of community outreach through his university (e.g. ASU's Night of the Open Door). He has participated in Ask and Expert programs, and he will be mentoring an undergraduate. Furthermore, his research could make

fundamental contributions to current understanding of genetic evolution and cancer development.

Summary Comments

Exceptionally strong applicant with a solid background in molecular biology, mathematics, and computation. His grades and letters of recommendation are excellent. His proposal is well-crafted and achievable with the potential to make a broad impact.