Intellectual Merit Criterion

Overall Assessment of Intellectual Merit

Excellent

Explanation to Applicant

Strengths: The applicant shows an academic record that is in good standing and supports its overall application. In the personal statement, the applicant discusses the career trajectory that has experienced and demonstrate the quite interdisciplinary skills that have had acquired over the years. The applicant very successfully integrates engineering with plant biology in their discussion of interests as well as how the applicant addresses problems. I did find quite appealing that the applicant is self-motivated, self-taught in aspects relevant to their research path, and has made a really good impression on mentors. In the research statement, the applicant proposes to use a novel approach that involves co-expression analysis coupled with metabolic profile as a way to understand how certain secondary plant metabolic compounds are produced and accumulated with the purpose of generating newer and effective medicines. In my opinion, the objectives are sound and independent from each other. Weaknesses: None

Broader Impacts Criterion

Overall Assessment of Broader Impacts

Good

Explanation to Applicant

Strengths: The applicant's broader impacts are focused around the proposed research project. The applicant's proposed project aims to relieve the strain placed on ecosystems caused by overharvesting of plants and repurposing of land for agricultural purposes. Furthermore, the applicant states that the development of more efficient production systems for plant-derived products will ensure that these products are accessible to those who need them. Weaknesses: The broader impacts seemed to be too centered around the proposed project and there is no clear strategy to generate a broader impact. For example, the applicant has quite a diverse experience in engineering and plant biology, it would be quite beneficial and appropriate if the applicant discussed reaching out to K-12 students and talk about these aspects of research. Also, the applicant should consider participating in discussion panels that talk about career trajectories and what were key moments that led the applicant in pursuing their career choice. I am certain that the applicant has some of these experiences, which it would have strengthen the application if they were integrated somehow.

Summary Comments

The application titled: "Uncovering the medicinal biochemistry of Scutellaria with a novel network-based approach" focuses on developing a transcriptomic and metabolomic co-expression network to understand biosynthesis of plant metabolic compounds that have medicinal properties. The first objective of the projects aims to generate the dataset from three different species of Scutelleria. The second objective aims to generate the molecular network to make predictions on functionality. The third and last objective will use transgenics to validate the discoveries made in the second objective in a model system (Nicotiana benthamiana).

Intellectual Merit Criterion

Overall Assessment of Intellectual Merit

Very Good

Explanation to Applicant

The applicant is impressive, and shows significant promise to become an outstanding scientist. Perhaps the most compelling aspect of their resume is the multidisciplinary nature of their proficiencies, and the refreshing view brought to old problems. Initially beginning undergraduate studies as a chemical engineer, they switched to agriculture information systems and genetics research. The combination of skills is noted in support letters as truly rare. Further, the applicant demonstrates they are no dilettante, having a first author publication! The project in the article seems to be conceived largely by the applicant. The research proposed by the applicant seeks to integrate accumulation of 4'-deoxyflavones with gene expression profiles determined by RNA seq to perform a network analysis in species of Scutellaria. By comparing organs and development in three species genes that are involved in production of 4'-deoxyflavones will be discovered. The research plan would benefit from proposing a target gene type or activity to be identified. How would finding a particular type of gene lead to an approach for enhancing production of 4'-deoxyflavones? Otherwise the project is methodologically sound and there is high confidence the applicant will be successful.

Broader Impacts Criterion

Overall Assessment of Broader Impacts
Good

Explanation to Applicant
The broader impacts are sparse. The applicant indicates that there would be benefit associated with the research such as greater production of 4'-deoxyflavones for clinical use as well as impacts on the sustainability of crops. This section would be improved with an outreach element. The applicant's area, especially sustainability aspects, would greatly benefit from outreach. Public suspicion around agriculture biotechnology may impede overall societal benefit of the project's research products.

Summary Comments
The applicant has an outstanding level of academic achievement: a perfect GPA, productive research projects, and a first author paper. The research project's goal are somewhat open ended and would benefit from greater definition of desired outcomes. Broader impacts could be improved through a communication strategy.

Intellectual Merit Criterion

Overall Assessment of Intellectual Merit
Very Good

Explanation to Applicant
To what extent do the proposed activities suggest and explore creative, original, or potentially transformative concepts? Combining multi-omics datasets using computational approaches is an exciting area of research and one in great need of developing for both plant sciences and other biological sciences. Is the plan for carrying out the proposed activities well-reasoned, well-organized, and based on a sound rationale? Does the plan incorporate a mechanism to assess success? The plan is well-reasoned with clear milestones. How well qualified is the individual, team, or institution to conduct the proposed activities? The applicants unique background in engineering and the associated skills in mathematics and programming poise him to be a capable researcher in his chosen area. Are there adequate resources available to the PI (either at the home institution or through collaborations) to carry out the proposed activities? yes

Broader Impacts Criterion

Overall Assessment of Broader Impacts
Fair

Explanation to Applicant

To what extent do the proposed activities suggest and explore creative, original, or potentially transformative concepts? The broader impacts of the proposed activities and the applicants past efforts in areas related to broader impacts could be better highlighted. The strong applied motivation of the proposal (in synthesizing a promising class of medicinal compounds), explores a creative broader impacts activity. Is the plan for carrying out the proposed activities well-reasoned, well-organized, and based on a sound rationale? Does the plan incorporate a mechanism to assess success? No clear plan for broader impacts was indicated How well qualified is the individual, team, or institution to conduct the proposed activities? While there was no clear broader impacts plan, the background of the applicant indicates a desire to promote open source tools, which are of benefit to the broader scientific community Are there adequate resources available to the PI (either at the home institution or through collaborations) to carry out the proposed activities? Can't evaluate.

Summary Comments

The application focuses on an important general problem in biology, but the plans promoting the broader impacts of the work could be greatly strengthened.