IIPD SUMMARY 2008

1. **How is the grant-funded activity resulting in an impact on student learning and enhancements to student success?**

I am in the process of completely revamping the combined lecture/laboratory format for Biology 104 (Animal Biology). The information gathered during the three-week period in Costa Rica and Panama this summer is invaluable to the success of these new combined lecture/laboratories and will be used for the construction of 3 new laboratories on evolution, cladistics, and Monarch migration. This new information will reach nearly 200 students this year.

In addition, students will be able to study the physiology of sphingid moths, create their own evolutionary trees (cladistics) from tropical *Heliconius* butterflies involved in Mullerian mimicry, and realize that not all Monarchs migrate!

Students will have the opportunity to understand the complexity of mimicry rings, and determine first hand how difficult it is to understand the evolutionary relationships between closely related butterflies. They will also have the opportunity to think creatively, to enhance their ability to think given limited facts, and to hypothesize and test scientific questions.

2. **What steps are you taking to assess the impact of this activity on student learning?**

Students are required to work on the “Monarch Report,” a basic hands-on investigatory research report that takes place during the entire semester. The research report counts for 10 percent of their grade and consists of essay questions, thought experiments, and actual observations of the butterfly’s metamorphosis during the semester.

In addition, students will be able to study the Monarch migration from the Midwest to Mexico from data assembled from previous IIPD grants, and incorporate their ideas as to why Monarchs in Costa Rica and Panama do not migrate. These are biophysical ecology questions that require a great deal of information and application of knowledge from their class work.

Students will also be required to create evolutionary trees based on physical characteristics of 5 closely related *Heliconius* butterflies from Costa Rica and Panama.
This will require that they identify valid characteristics and use basic mathematics to support their evolutionary trees.

We also intend to use sphingid hawkmoths to study respiration and flight dynamics in hovering animals. These behavioral observations were initially made in the mountains of Costa Rica and Panama.

3. Describe the new avenues of instruction, including changes in curriculum, teaching strategies or other changes that are resulting from your grant-funded activity.

All students must participate in the observation of butterflies mating, ovipositing, developing, and metamorphosing into adults. The teaching strategies are primarily hands-on observations, manipulation of experimental design, and recording the results.

Students love puzzles, and the cladistics experiment with the mimicry complex of tropical butterflies will engender a great deal of interest and discussion. The answers, of course, are unknown, and once students realize this, they should be very open to group discussion and hypothesis-making and testing.

The Monarch is a well-known butterfly, but we still know and understand virtually nothing about its life strategy and evolutionary history.

Likewise, the Heliconius group of tropical butterflies is well known, but the cladistics and evolutionary relationships between the different species and their various geographic forms and races is still widely debated. They will have the opportunity to enter into current scientific debates in both these areas of cladistic and evolutionary research.

4. How are you engaging others in the learning process and disseminating activity results with the wider campus community?

Each year I give a seminar, either to the entire GRCC campus, or to student groups, that basically updates those attending on the new information we have discovered from the previous summer’s research.

I also give numerous talks to grade school, college, and university groups, as well as have public releases of Monarchs during the late summer and fall. These public releases of Monarchs are almost always picked up by the local, state, and sometimes the national media, including NPR.

This year I’ll be offering a “butterfly class” concentrating on Monarchs and butterfly gardening to older learners both at Aquinas College and GRCC.
5. Describe how the funded activity is supporting the objectives of your department and your existing job responsibilities.

These grants allow me to investigate an incredibly interesting group of animals, deliver new information to faculty, students, and the greater community of West Michigan. These objectives are the same as our departmental objectives: to teach, to conduct original research for our students, to publish, and to inform others in the nonacademic community of the mysteries with the Animal Kingdom.

6. How has this grant helped in fostering your professional development goals?

These grants have allowed me to become more expert in the life history strategies of the Monarch butterfly and Heliconius butterflies. This success, of course, reflects directly on the academic reputation of GRCC via media reports, scientific papers, scientific seminars at national and international meetings, and books. Without these grants I would not be able to pursue my goals of understanding one of Nature’s greatest mysteries (the Monarch migration), as well as understanding the intricate processes of evolution through the vehicle of cladistic analysis of mimetic butterflies.

Respectfully submitted,

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