Course Justifications for ANSC 650 (DNA and Genetic Analysis)

1. **What is the new course?**
   The title of this new course is “DNA and Genetic Analysis”. This course focuses on learning basic molecular genetics techniques. It will cover the basic and advanced techniques used for DNA-based genetic analysis, including recombinant DNA technique, DNA marker identifications, DNA fragment analysis, transgenics, gene expression analysis and functional genomics.

2. **Why is the course being requested?**
   Genes, their regulations and genetic control of biological mechanisms have developed into a central focus of life science research and education. More than ever before, molecular technology is showing us how to recognize and study biological connections among different cells, tissues and organs within an animal. Identifications of genetic material DNA and genetic analysis in different species not only open new areas of scientific investigations, but also have practical applications to animal agriculture, aquaculture and biological conservation. Along with completions of the genomes of human, mouse, cattle and other species, many important genes have been discovered to be involved in various biological processes in the past decade. It is necessary for graduate student majoring in animal science and other biological programs to learn the knowledge and laboratory techniques in DNA-based genetic analysis. In the current curriculum of animal science graduate program at the University of Hawaii, there is not a specific course that focuses on DNA-based genetic analysis. Therefore, this course is proposed to provide instructions in DNA-based laboratory technology and its applications to genetic analysis of various species important to agriculture, aquaculture and biological conservations. The offering of this course will not only enhance the animal science graduate curriculum, but also stimulate interests in molecular technology for animal agriculture.

3. **How will the content be organized?**
   This course contains five topics: 1) the basic technology of DNA and DNA manipulation; 2) gene mutations, microsatellite DNA and genetic analysis; 3) from DNA to phenotype and functional genomics; 4) impacts of genetic variations; 5) applications of DNA-based genetic analysis to research projects in the area of animal genetics, conservations, nutrition, and biomedical research. The course will be mostly instructed by classroom
lectures and laboratory demonstrations, and practices. The fourth and fifth topic will be taught by critical review of publications and student oral presentations in combination with writing assignments. It is a combined lecture and laboratory course for graduate students.

4. **What other courses at UHM closely parallel the proposed course, and in what way will the latter make a distinct contribution?**

Several courses related to molecular biology and biotechnology are listed in the UHM course catalog. These include BIOL/MBBE 304 (Ethics of Biotechnology), MBBE/BIOL 401 (Molecular Biotechnology), BIOL 407 (Molecular Biology), BIOL 275 (Cell & Molecular Biology), CMB 680 (Cell and Molecular Biology), and ANSC 445 (Gene and Animal Biology). In general, these courses are comprehensive and cover basic principles of molecular biology and genetics. For example, MBBE 401 instructs basic principles, applications and approaches of biotechnology from prokaryotic to eucaryotic cells. Some students majoring in animal science may be interested in learning the molecular knowledge of animals and marine species. The proposed course differs significantly from these basic molecular biology courses in that an emphasis is placed on DNA and genetic analysis and the practical aspects to animal scientists- the applications of the DNA technology for agriculture, aquaculture, and species conservations. It also has laboratory sections. MBBE students are very interested in this course. Therefore, the course is named as “DNA and Genetic Analysis”. This course will make a distinct contribution by integrating current knowledge of genes and DNA technology with their applications to animal agriculture, aquaculture and species conservations.

5. **Where and how does the proposed course fit into the current and future curriculum?**

The proposed course is intended to provide advanced training in animal molecular genetics for animal science graduate students. In the current graduate student curriculum, we have courses at the intermediate levels such as ANSC 445 (animal genetics), ANSC 446 (Genes and Animal Biology), ANSC 450 (Aquaculture), ANSC 451 (Animal Physiology), and ANSC 454 (Muscle biology). We also have several courses for graduate students, including ANSC 603 (Experimental Design), ANSC 642 (Advanced Animal
Nutrition), ANSC 643 (Physiology of Reproduction), ANSC 644 (Growth Biology) and ANSC 687 (Advanced Laboratory Techniques). The current animal science graduate curriculum is comprehensive in general animal science training. However, as we approach an understanding of animal genetics, growth, reproduction, lactation and nutrition at the gene and molecular level, we certainly need to teach the students important genes for livestock animals, DNA-based new technology for animal breeding and conservations. The new course of “DNA and Genetic Analysis” fit the current curriculum very well. By offering this course, the animal science graduate curriculum at the UHM will be entering a higher level of graduate education in the field of animal science. A high proportion of animal science graduate students at the UHM are interested in aquaculture and marine species. An increasing number of students are interested in marine species conservation, scientific research and technology development. There are needs in animal science education to emphasize the curriculum development that are favorable for molecular biology and new technology training. The new course of “DNA and Genetic Analysis” will not only focus on DNA-based genetic technology, but also instruct practical and potential applications of technology to the scientific research in agriculture, aquaculture and biologic conservations. Therefore, this course also fit future animal science graduate student curriculum.

6. **Why is the number of credits and level justified? Explain the prerequisites and the absence thereof.**

This course will include intensive lectures covering basic knowledge in DNA, gene expression and genetic analysis, as well as the applications of the technology to animal research and agriculture. In addition to classroom lecture, laboratory demonstration, group discussion and student presentations will also be used in the instruction. To get a comprehensive understanding of important contents and details in this subject, this course will need to be instructed two times a week (225 minute in total) with one session for lecture (75 minutes) and one session for laboratory (2 hr and 30 minutes), so a two-credit course is suggested. In term of prerequisite, basic knowledge of biological systems is necessary to understand lectures. A basic biology course (BIOL 171), and courses in animal science or genetics such as ANSC 445 or equivalents has been suggested.
7. **How will the course assist students to achieve the critical skills and competencies expected of CTAHR graduates?**
   
   i. Written communications. Students will be required to write two essays, which will be critically evaluated by the instructor.
   
   ii. Oral Communications: Student presentation in combination with the writing assignment will be arranged after lecture instructions of basic knowledge in genes and molecular biology. Group or individual advice will be given by the instructor.
   
   iii. Analytical/Problem Solving skills. The important concepts on DNA and genetic analysis and their applications in animal science will be presented in the lectures, which will be used as examples for analyzing problem-solving training through class discussion.
   
   iv. Leadership/Person characteristics/Human Relation skills: Students will be encouraged to take initiative and take pride in help organizing group discussion and presentations.
   
   v. Computer skills. DNA sequence and genomic informatics will be demonstrated through human genome database. Students are encouraged to gain practical experiences using computer to gain genes and molecular knowledge through available websites.
   
   vi. “Real World” experience. Examples about successful DNA and genetic analysis for animal breeding and conservation, along with problems associated the technology will be discussed in the class to help students understand the “Real World” business of new technology development.

8. **How will students be evaluated?**

   Students will be evaluated via their exam performances and writing assignment. Exams basically test their knowledge and analyzing skills, while the writing assignment will be evaluate their working capability and the skills of applying the knowledge to solving some problems. Evaluation includes mid-term examinations (30 points), student presentation (15 points), essay assignment (15 points), quiz and class attendance (10 points), and final exam (30 points). Grades will be assigned using the scale (A: >90 points; B: 80-89 points; C: 70-79 points; D: 60-69 points, F : <60 points).
9. **What are the minimum qualifications for teaching this course? Is a qualified instructor available?**

   This course is an integration of molecular genetics, animal genomics and their applications to animal science. The instructor is required to have training and working experiences in molecular biology in context with animal science application. This course will be initially instructed by Dr. Jinzeng Yang in the Department of Human Nutrition, Food and Animal Science. Dr. Yang has the appropriate training and research experiences to serve as the instructor for this course.

10. **How will the course be financed, assuming no further cutbacks?**

    This course is primarily based on classroom and laboratory teaching, student presentation and laboratory experimental demonstration. The resources will be from existing educational funds within the academic units. We may need some funds to purchase teaching materials and molecular reagents for classroom demonstrations and laboratory practices, which will be obtained from the animal science program or the CTAHR. Instructor Dr. Yang’s lab and departmental teaching laboratory have necessary instruments for this course. Since this is a new course and it is related to teaching and training of new technologies, the instructor may seek external funding from USDA and NSF for the development of educational program in DNA-based technology for marine species conservations.

11. **Has the course been offered before? Is there a demand for it?**

    This course has not been offered before. However, there is a great demand for training animal science students with knowledge in animal molecular genetics and genomics. As a fact, most animal science programs in the other agricultural colleges have graduate courses focusing on animal genomics, genetic analysis biology. Graduate students majoring in animal science are interested in learning DNA-based genetic knowledge in understanding animal biology and physiology, which will not only increase their career opportunities but also stimulates their further interests in developing new technology for animal agriculture and aquaculture.

12. **Is the course cross-listed with another department?**

    Yes, it is proposed to be cross-listed in FSHN and MBBE program in CTAHR.