1. Relationship to the current program curricula

The use of DNA based tools revolutionized Evolutionary Biology and has since allowed in depth exploration of new questions regarding Behavioral, Physiological and Community Ecology, Parasitology, and Epidemiology. "Molecular tools in Entomology" is being offered as a recruiting course offered at the undergraduate level for majors. The course will also accommodate graduate level students by further providing exploratory and mentoring opportunities (MS and PhD entomology, DEENR students from Rutgers, and MPH students from the School of Public Health).

2. Relationship to other courses

Introductory Biology is the only requirement for this course. The course will be taught in the same semester as "Case Studies in Vector Borne Diseases" (CSI-VBD) a graduate and upper level undergraduate course, but in alternate years. "Molecular Tools in Entomology" will become a course requirement for CSI-VBD and is likely to become a requirement for several courses in the Department of Ecology, Evolution, and Natural Resources, as well as multiple courses in the Department of Human Ecology and Public Health (UMDNJ).

3. Course Description

Molecular Tools in Entomology, Ecology, and Epidemiology
Dr. Dina M. Fonseca, dinafons@rci.rutgers.edu

Course Learning Goals

Instructor's Goals:
This course aims to provide students with hands-on experience in basic molecular biology strategies: DNA extraction, Polymerase Chain Reaction (PCR), quantitative PCR, primer design and optimization, DNA blocking strategies cloning, Sanger sequencing, Fragment sizing, NextGeneration sequencing. I will be able to take on up to 10 students each year by using the resources in my laboratory. Once the students are familiar and confortable with the advantages and disadvantages of these basic tools I will expose them to specific questions in Entomology such as (1) Cryptic species identification (including parasites and endosymbionts); (2) Selective mutations (eg. associated with the origin and spread of insecticide resistance); (3) Epidemiological sleuthing (blood meal analysis, gut microbiota); (4) Origin and spread of invasive species; (5) Genetic modification for pest or disease control. A third of the course will be devoted to providing a working knowledge of analysis methods such as Probability theory, Bayesian Statistics, and Population Genetics. Importantly, the aim of this course is not to substitute Statistics or Population Genetics but instead is to provide an introduction and an incentive for the students to take those courses.

My aim is to provide the students with (1) hands on experience in the methodology; (2) exposure to questions that can be addressed using these methods; (3) a working understanding of the opportunities and limitations of the methods, which includes a good grasp of the analyses.

Student Goals:
A successful student in this course will be familiar with molecular genetics as applied to Entomology, Ecology, Evolution, Public Health, and will have a working understanding of the best tools and the latest and most appropriate analyses.

There are clear and measurable objectives for students participating in this course. After this course, students will be able to 1) relate DNA based tools to entomology, ecology, and epidemiology; 2) evaluate the quality of scientific data and hypotheses in studies that employ Molecular biology as a tool by analyzing the methods used, the reported results, and the authors approach; 3) research and present information during and after collaborative work.

Assessment:
The students' course progression will be assessed by examining their performance in the laboratory and through written and oral presentations. Knowledge of the background content – obtained by literature searches, discussions with me and with fellow students as well as researchers and public health officials (during invited talks) – will be measured in so far as it relates to the specific problem being tackled. As a result, final knowledge content will likely vary between students and will reflect their specific interests and career goals, as well as their initial level – undergraduate, graduate, major, non-major. However, core ecological and evolutionary principles, as well as several molecular biology methodologies, will be covered since they will undoubtedly permeate any discussion and be critical to address a public health problem.

Grading – Tests and in class participation – especially presentations and contribution to journal clubs - are each 50% of the grade.

TEXT- there is no required text. Materials from a variety of sources will be provided each week, including an outline of the notes for the class. We will discuss actual published studies using the latest molecular tools. Some representative one will be chosen by me but most will be chosen by the students so they will be closer to their own interests.

Molecular Tools in Entomology, Ecology, and Epidemiology

Course Number 11:370:410:01
FALL SEMESTER – 2013
Dr. Dina M. Fonseca, dinafons@rci.rutgers.edu or fonseca@aesop.rutgers.edu

Lessons #	Topic
1)	a) Course overview and requirements b) SENCER-SALG (pre-course assessment) c) What are molecular (DNA) based tools?
2)	a) 5 minute quiz b) DNA and Polymerase Chain reaction
3)	a) Primers and Primer Design

b) Group evaluations and discussion

4) a) Cloning and Sanger Sequencing
b) DNA sequence and mutations
c) Blocking – the strategy, applications

5) a) Fragment Analysis
b) DNA fingerprints

6) First exam

7) a) NextGen Sequencing
b) The advent of Genomics

8) a) Applications of Molecular Tools in Entomology (Ecology, Evolution, Parasitology, Epidemiology) 1

9) Applications of Molecular Tools in Entomology (Ecology, Evolution, Parasitology, Epidemiology) 2 – Student contributions

10) Applications of Molecular Tools in Entomology (Ecology, Evolution, Parasitology, Epidemiology) 3 – Student contributions

11) Applications of Molecular Tools in Entomology (Ecology, Evolution, Parasitology, Epidemiology) 4 – Student contributions

12) Second exam

13) a) Overview of Analyses tools

14) a) 5 minute quiz
b) Group discussion (journal club)
c) SENCER-SALG (post-course assessment)