ABI 187 Practicum Proposal for Albert Einstein:
Blowfly Landing and Oviposition Rates on DEET-Treated Human Beings

Student:

_____________________________    ___________________________    __
Signature                                    Printed name                                           Date

Academic Advisor:

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Signature                                    Printed name                                           Date

Practicum Mentor:

_____________________________    ___________________________    __
Signature                                    Printed name                                           Date
Albert Einstein
Animal Biology Major with an Emphasis in Medical and Veterinary Entomology

Projected Graduation: September 2011

Academic Advisor: Elvira G. Hack. Department of Animal Biology

Blowfly Landing and Oviposition Rates on DEET-Treated Human Remains

Mentor: Robert B. Kimsey Ph.D. Department of Entomology. 396B Briggs Hall.

University of California at Davis.

February 11, 2011
Blowfly Landing and Oviposition Rates on DEET-Treated Human Beings

It is well known that insects are attracted to decedents immediately after death. Patterns of arthropod succession on carrion have been well studied. Different taxa arrive at the corpse during different stages of decay to feed or lay eggs. More often, blowflies (Calliphoridae) are the first insects to detect a decedent and will lay eggs if conditions are favorable (Charabidze et al., 2009). Forensic entomologists can use the species of insect and its stage in development to determine a minimum postmortem interval, or minimum PMI (Byrd & Castner, 2000). However, by preventing insects from immediately landing on a decedent, PMI accuracy may be compromised (Anderson, 2001). Given the widespread use of insect repellents containing N,N-Diethyl-meta-toluamide (DEET), it is important to consider their effect on blowfly oviposition and a subsequent underestimation of the PMI.

DEET is commonly used to prevent irritating and potentially dangerous bites from several genera of mosquitoes (Annis 1990, 1991; Barnard et al, 2002; Frances et al, 1996). Further studies have shown affects on other blood-seeking invertebrates including sand flies (Alexander et al, 1995), assassin bugs (Alzogaray et al, 2000), Simullid flies (Debboun et al, 2000), Tsetse flies (Sholdt et al, 1989), face flies (Blume et al, 1971), ticks (Carroll et al, 2005), and even leeches (Kochhar et al, 1974). Previously, it was thought that DEET inhibited olfactory sensory neurons masking host odors that attract mosquitoes (Ditzen et al., 2008). In contrast, Syed and Leal (2008) have shown that mosquitoes possess DEET-detecting olfactory receptor neurons and directly detect and avoid the compound. Klocke et al. (1987) found that 1,8-cineole (Eucalyptol), another commonly used insect repellent, not only deters mosquito feeding, but also delays or completely inhibits oviposition. By preventing egg-laying, decomposition may be slowed without the aid of insect colonizers. Furthermore, the PMI cannot be determined by using the size of third instar larvae in relation to temperature. With delayed egg-laying and hatching, the subsequent development of first, second, and third instar maggots occurs at slower rates resulting in an underestimation of the PMI.

It may be that DEET affects oviposition by initial colonizers of carrion such as blowflies. Accordingly, we (1) selected a rural study site and set out five piglets, four topically treated with a commercially available form of 100% DEET, and recorded the periods between exposure and (2) landing of flies (3) egg-laying, and (4) appearance of 1st and 2nd instar larvae. We ended the experiment when third instar larvae first wandered, and (5) extracted all remaining insects, and (6) measured the total volume of maggots on each piglet. In particular we sought evidence that DEET delays visitation by blow flies, carrion colonization by maggots, and thus delays carrion decomposition in comparison to non-treated carrion.
Timetable:

To Date: Two runs of the experiment were completed during summer 2010. A rough manuscript of the research has been completed.

Spring Quarter 2011: Complete edits of the manuscript and submit to scientific journal.

Summer 2012: Make any edits requested by the journal or complete any replicates of the experiment that are needed. Write separate analysis of the research for my ABI practicum (this is separate from the joint paper written by the Matan Shelomi, Leia Mattern, and I). I plan on writing my ABI practicum with an emphasis in forensics rather than insect behavior.

Importance to Self, Society, and Biology:

I chose to do this project because I’m interested in pursuing research in my career and have a personal interest in entomology. Bob’s forensic entomology class was an excellent introduction to learning how to formulate a hypothesis, design an experiment, conduct fieldwork, and combine that information into a format required by scientific journals. However, my forensic entomology group’s experiment, like many first attempts, had many flaws. It did, however, show some promising results that could have important implications for the forensic entomology community and current research about mechanisms for how insecticides work (Walter Leal’s work on DEET detecting receptors and the direct avoidance of DEET by mosquitoes). My group and I decided to redesign our experiment, modify our hypothesis, and continue our research after the conclusion of Bob’s forensic entomology class. By continuing on with the experiment, I feel I have gained valuable research experience and learned that science is very much an ongoing process.

The value of our research has many applications. As mentioned before, it supports Walter Leal’s work at University of California Davis, providing some evidence for DEET avoidance behavior. Furthermore, it could be useful in forensic entomology when determining a postmortem interval, or PMI. Under special circumstances, the period of infestation could be delayed if a decedent has been exposed to DEET prior to death. This could be valuable, for example, if a hiker became lost in the woods.

Academic Plan:

Completed Fall 2009

Ent 100: Build background knowledge of entomology required for research including basic anatomy, behavior, ecology. (4 units)

Ent 100L: Learn the basics of insect collecting and identification (1 unit)
**Completed Winter 2010**

**Ent 104:** Begin to develop a basic understanding of insect behavior. We are targeting our research towards and applied behavioral journal. (3 units)

**Ent 158:** Gain a greater understanding of how insects affect humans and animals (medical and veterinary entomology). Receive a brief overview of forensic entomology. Analyze many scientific journals and gain a better appreciation for how they are written and organized. (4 units)

**Completed Spring 2010**

**Ent 156:** Continue learning about insect affects on humans. In detail discussion of many genera that are significant to forensics (3 units)

**Ent 156L:** Laboratory experience. Practice using dissecting scopes and microscopes. (1 unit)

**Ent 158:** Learned an overview of forensic entomology, how to formulate a hypothesis, conduct research, and write a scientific paper. Began formulating the hypothesis that we later tested in my ABI practicum (3 units).

**Ent 199:** Organized specimens at the Bohart museum. Gained experience recognizing and IDing forensically significant arthropods. (1 unit).

**To Be Completed Summer 2011**

**UWP 104E:** Gain experience in scientific writing before finishing my write up for the research (4 units).

**Ent 199:** Practice identifying maggots and taking measurements to determine their growth as a function of time and temperature.

**Curriculum Vitae:**

Albert Einstein  
United States of America  
03-14-1879  
451-925-4554  
eainstein@ucdavis.edu

Currently, my academic interests include biochemistry, animal science, biology, and medical and veterinary entomology. In the future, I plan to attend veterinary school specializing in wildlife medicine, infectious diseases, or medical and veterinary entomology. Alternatively, I would enjoy working in wildlife conservation or epidemiology. In my spare time, I enjoy working on research projects at University...
California Davis, interning at veterinary hospitals, and volunteering my time to help foster kittens for the Orphan Kitten Project run though the UC Davis Veterinary School.

**Education:**

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<th>Location</th>
<th>Major</th>
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<td>February 2006</td>
<td>University of Puget Sound</td>
<td>Tacoma, WA</td>
<td>Biology Major</td>
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<td>Member of Alpha Phi Sorority</td>
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<td>June 2009</td>
<td>Diablo Valley College</td>
<td>Pleasant Hill, CA</td>
<td>Biology Major</td>
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<td>Present</td>
<td>University California Davis</td>
<td>Davis, CA</td>
<td>College of Agricultural and Environmental Sciences</td>
<td>3.65</td>
<td>Animal Biology Major Medical and Veterinary Entomology Emphasis</td>
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**Motis Operandi:** Utilize student database and health resource libraries to supplement background information in my practicum research. Networked as an undergraduate to learn about additional research projects, volunteer opportunities, and gain experience before graduation.

**Work and Volunteer Experience:**

March 2007-December 2008 **VETCARE EMERGENCY AND SPECIALTY CARE CENTER.**

*Admit and Triage Nurse*

- Responsible for obtaining patient histories and building strong client rapport
- Obtained any blood work or patient histories from the RDVM and/or IDEXX
- Obtained basic vitals and determined critical or stable status of patients waiting to be seen
- Explained the need for emergency authorization to begin treatment on critically ill patients
- Presented estimates to clients and discussed alternative treatment plans and payment methods such as Carecredit
- Discharged patients with detailed instructions for further care at home

*Treatment Nurse*

- Responsible for monitoring and providing treatment for all in hospital patients including post-surgery, Parvo, and the critically ill
- Administration of oral, subcutaneous, intravenous, and intramuscular drugs
- Hourly monitoring, daily walks, and other basic care

**Veterinary Assistant**
- Assisted in restraint for injections including venipuncture
- Helped doctors during procedures which included opening sterile packs, flushing wounds, flushing urinary catheters in blocked cats, etc.
- Knowledge of commonly used veterinary medications and able to correctly fill prescriptions
- Able to calculate drug and fluid doses, prepare fluid bags and pumps, etc.
- Able to take digital radiographs
- Efficient at making sure the hospital is clean and organized
- Attended continued education classes in correct and safe bandage placement and how to monitor an ECG

**Instrument Technician**
- Experienced and proficient in correctly cleaning, packing, and sterilizing surgical instruments.
- Able to operate and clean autoclave and magnaclove

**Relief for Reception**
- Provided short relief for reception during their lunch breaks
- Able to check patients in, answer phones, discuss finances, copy, fax, etc.
- Attended continued education classes in customer service.
- Comfortable in maintaining rapport with clients, acting professional when dealing with difficult clients, and displaying compassion and sensitivity in dealing with clients suffering from loss

**February 2004 – December 2007 RHEEM VETERINARY HOSPITAL Moraga, CA**

**Veterinary Assistant**
- Responsible for keeping the hospital clean and organized
- Cleaned and disinfected kennels
- Walked, fed, and medicated hospital patients
- Responsible for basic restraint, lab samples, and administering vaccines

**SKILLS**
- Skilled at managing multiple problems with competing priorities
- Currently proficient in DVMaxx, Eklin digital radiology, Microsoft Word, and Excel
- Quick to learn new computer programs
- Exceptionally organized and goal oriented.
- Outstanding writing, communication, and interpersonal skills

ACTIVITIES

- Volunteer foster for the Orphan Kitten Project-UCDavis
- Vet SOS, an organization providing medical care to the pets of San Francisco’s homeless – Volunteer
- Oakland Zoo – Volunteered working with exotic zoo animals
- Member of the Oakland Strokes Crew team – Coxswain

REFERENCES:

Dr. Richard Johnson- Dr. Johnson can vouch for my work ethic, commitment to patient care, humanity, and passion for medicine.
925-376-5976

Dr. Bob Kimsey- Dr. Kimsey has been my professor for four courses and three labs. He has also guest lectured in several additional courses. In addition, we have done continued research together. He can vouch for my commitment to academics, detail-oriented work ethic, and love for science.
rbkimsey@ucdavis.edu