

DISCUSSIONS

CASE WESTERN RESERVE UNIVERSITY UNDERGRADUATE RESEARCH JOURNAL

FEATURING:

Adaptations and Preferences of
Wild Hummingbirds Introduced
into a Captive Setting
Joshua Barzilai

A Genome Wide Search for Proteins
that Control the Balance between
Proliferation and Differentiation
in the *Drosophila* Ovary, an in vivo
Model System
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Turning Behaviors in the
Cockroach *Blaberus*
discoidealis
Solomon J. Awe

Additionally

Amanda Kittoe
Jen Gulas
& *Himali Bhatt*



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TABLE OF CONTENTS

- | | |
|------|---|
| [4] | Celiac Disease: A Maladaptive Mismatch to Current Lifestyles
<i>Himali Bhatt</i> |
| [5] | Adaptations and Preferences of Wild Hummingbirds Introduced into a Captive Setting
<i>Joshua Barzilai</i> |
| [14] | A Genome Wide Search for Proteins that Control the Balance Between Proliferation and Differentiation in the <i>Drosophila</i> Ovary, An <i>in vivo</i> Model System
<i>Avanti Jakatdar</i> |
| [22] | Turning Behaviors in the Cockroach <i>Blaberus discoidalis</i>
<i>Solomon J. Awe</i> |
| [26] | Covariation in Limb-limb and Limb-trunk Proportions in Whites and Blacks and Males in Females using the Hamann Todd Collection, Cleveland Museum of Natural History
<i>Amanda Kittoe</i> |
| [40] | Nada es Sencilla: un Análisis de Cinco Películas Almodovareñas
<i>Jen Gulas</i> |
-

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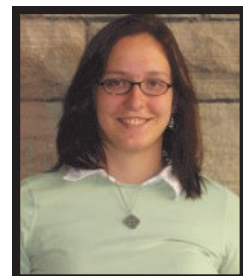
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Letter from the Editors

Letter from the Editors:

For this semester, *Discussions* trialed implementing Copy Editors. Each Copy Editor focused on a specific paper and worked with the author on possible corrections and improvements, then forwarded the completed paper to the Managing Editor for assembly into the journal. We had a few hiccups in the timeline adjusting to this new style, but we'll continue to streamline the process in the future. We hope the addition of Copy Editors will help us achieve a higher level of personal attention for authors as well as provide new outlets for group involvement within *Discussions*.

We're also proud of the continued diversity of our articles. This publication contains research encompassing ecology, anthropology, biology, and Spanish culture. For the very first time, *Discussions* is publishing a paper written in a foreign language, *Nada es Sencilla: un Análisis de Cinco Películas Almodovareñas*. While this issue is rather largely populated with scientific research articles, do not forget that we enjoy publishing papers from every discipline. Submit your humanities papers for next spring, too!

Last spring we tested out the use of CDs as means of distributing the journal. We set out both CDs and hard journals on our booth at several events recently and our readers largely preferred the hard journals to the CD copies. For this reason, we have decided to discontinue the distribution of *Discussions* on CD. However, we shall continue to develop new ways of making the journal more accessible, and we are always open to fresh ideas.

This copy of *Discussions* is the third to be published biannually, and we are grateful that the Case Western Reserve University community continues to submit such high quality work to us so frequently. Remember, we cannot make a journal without your submissions. Additionally, this is the second edition to be printed entirely in color, and many of this copy's authors use the color to great effect in their articles. Check them out!

Thank you for picking up the Fall 2008 issue of *Discussions*. We hope you enjoy it.

Aditi Sinha and Sean Yeldell
Editor-in-Chief and Managing Editor

Celiac Disease: A Maladaptive Mismatch to Current Lifestyles



-Himali Bhatt-

Himali Bhatt is third year student at Case Western Reserve University. She is currently studying Anthropology with a concentration in Health Science as well as Pre-Medicine. She is also minoring in English and Chemistry. After completing her undergraduate degree, she plans to attend medical school. When not studying, Himali enjoys doing Bharatnatyam and writing.

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I would like to thank Dr. Cynthia Beall for her help and guidance in writing this paper and for teaching the course for which this paper was written.

ABSTRACT

Celiac disease, an autoimmune disorder, is a maladaptive mismatch between our current lifestyles and diet based upon genetic and environmental factors. It is classified as an autoimmune disorder because it produces an immune response against the intestines in the form of inflammation when an afflicted person's T-cells encounter α -gliadin DQ2 or DQ8 complex (Molberg et al., 2005). Our diets changed as a result of food domestication when we transitioned from nomadic hunters and gatherers to sedentary agriculturalists (Connon, 2005; Rostami et al., 2004). Furthermore, the foods that were grown have become increasingly complex genetically over time, and the DD genome was introduced into a particular strain of bread wheat that may be responsible stimulating T-cells when its α -gliadin fragment binds with DQ2 or DQ8 molecules causing inflammation in the intestine (Molberg et al., 2005). The food domestication hypothesis suggests that it was the domestication of wheat that led to the emergence and spread of celiac disease. In addition, declining practices of breastfeeding and early weaning of infants in countries corresponds to increasing occurrences of celiac disease in certain countries and earlier ages when symptoms of the disease are now being seen (Connon, 2005; Challacombe et al., 1997; The WHO Global Data Bank). Finally, the age of gluten introduction hypothesis indicates that there is some correlation between the age when gluten is introduced to a child's diet and the child's age of onset of symptoms occurs later in life (Challacombe et al., 1997; Peters et al., 2001). These three hypotheses indicate that the way we now live and some of the foods we now consume have made us more vulnerable to celiac disease, compared to our ancestors (Myserud et al., 2008), and we may not be as adapted to our modern lifestyle and diet as we originally believed.

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Adaptations and Preferences of Wild Hummingbirds Introduced into a Captive Setting



-Joshua Barzilai -

Josh Barzilai is a third year junior at CWRU, majoring in Biology, Chemistry, and German, with the future hope of going to medical school. Outside of class, Josh is an active member of the Alpha Epsilon Pi fraternity, and the co-founder and president of the Case Biology Society. Currently Josh is trying to found a local Tri Beta chapter, the honor biology society, on campus.

-Acknowledgements-

I would like to thank Dr. Kristen Lukas for her help throughout the duration of my research. I would also like to thank the staff in the Bird Department at the Brookfield zoo. I would especially like to thank my mentor at the zoo, Mr. Lee Stahl, who was always there to guide me, and help me in whatever way needed. I would also like to thank Megan Ross and Elena A. Hoellein for their ideas and support.

ABSTRACT

This case study focuses on the effects of avian introductions into a captive exhibit. Two hummingbirds, *Colibri coruscans* (sparkling violet eared) and *Anthracothorax prevostii* (green breasted mango), were both observed over an 8 week period as they were reintroduced into a recently remodeled Free Flight Exhibit, located at Perching Bird house of the Brookfield Zoo in Chicago, Illinois. Prior to introduction, the birds were held in isolation holding. In both the zoo and isolation, the subjects were observed on their location, social proximity, and behavior. The questions of whether the subjects would have a preference in location and whether a change in behavior while in captivity were studied. The end result was that both birds showed preferences of location in the exhibit, as well as an increased perching behavior, greater than what is observed in their natural habitats.

INTRODUCTION

The Free Flight exhibit at the Brookfield Zoo is large aviary enclosure that houses several varieties of birds. This enclosure has a wide array of trees and plants that are separated in the middle by a large winding stream that gives the birds, within the exhibit, a wide selection of perches and other necessities. However, recently the exhibit was closed and remodeled. The roof panels were removed and replaced with clear transparent windows to allow sunlight into the exhibit; the walls were repainted to give the impression that the exhibit was on the top of a mountain; and the flora (trees and floor plants) in the exhibit



Figure 1. The Free Flight exhibit at the Brookfield Zoo

were changed. The end result was a new environment that mirrored an entirely new habitat.

The two hummingbirds that were observed for a period of 8 weeks were the male *Colibri coruscans* and female *Anthracothorax prevostii* hummingbirds. Both hummingbirds are members of the family Trochilidae and are native to either Central or South America.

C. coruscans is characterized by its all green body with stripes of violet around both eyes and is native to North West South America, mainly NW Venezuela and Columbia through Ecuador and Peru to Bolivia and NW Argentina (Campbell 1974). Its particular habitat or niche includes forest edges, open woodland, flowering gardens, and plantations. These habitats are ideal for *C. coruscans*, as its primary food sources are

nectar from flowers and small insects, both of which are abundant in such a tropical region (Perrins 2003). It is known to migrate for food, although this is mainly done during dry seasons.

A. prevostii also has an all green body, most noticeable in its breast. Another characteristic of *A. prevostii* is its decurved bill (Alderfer 2005). *A. prevostii* is most commonly found in central and the northern South America. It usually inhabits open grassy or shrubby areas with scattered taller trees, especially near water, savannas pastures, parks, gardens, shaded coffee plantations, and other sparsely lowland forests at an elevation between 900-1200 Meters. *A. prevostii* mainly feeds on the nectar of brightly-hued plants and small insects (Perrins 2003). It is not known to migrate

long distances; however, its movements are known to correlate based on the local flora.

The purpose of this case study is to observe the behavior of two of the exhibit's residents, *Colibri coruscans* (Sparkling violet eared) and *Anthracothorax prevostii* (Green Breasted Mango) hummingbirds, both while they are in holding, and after they are reintroduced into Free Flight. These observations will focus on monitoring their location within the exhibit, their social proximity to other birds, and their behavior at specific intervals. The purpose of collecting this data is to help answer the questions, "Do these hummingbirds have particular preferences in terms of habitat within a captive environment?" and "Does captivity drive the actions/behaviors of these birds? Do they differ from what is witnessed in the wild, and if so why?" The end goal is to use the preferences and adaptations of these birds to gain more information about them in a captive setting and understand how to better design exhibits in the future.

MATERIALS AND METHODS

The subjects of this study were the *Colibri coruscans* (Sparkling violet eared) and *Anthracothorax prevostii* (Green Breasted Mango) hummingbirds. Both birds were on display at the Brookfield Zoo. The specific age of both hummingbirds was unknown since they were originally from the wild. At the start of the observations, both birds were housed in an off exhibit holding area; this lasted for about 2 weeks and they were later moved into the Free Flight Aviary in the Perching Bird House.

Data for both subjects was collected via the in-

stantaneous sample collection method. Each subject was individually observed for 15 minutes in the morning (approximately 10am) and again individually observed for 15 minutes in the afternoon (approximately 2pm) for approximately 8 weeks. Times of observation varied slightly as the upkeep of the exhibit delayed the start of the observations. To avoid observing the animals after being disturbed, an additional 5 minutes were allotted, and the new observation start time was noted. The subjects were observed for the following criteria every minute: location, social proximity, and behavior during the 15 minute observation period.

The location of the subjects was recorded by mapping the exhibit into approximately equal sized quadrants. These quadrants was later be used to help record the location of each subject at each 1 minute instantaneous sampling interval.

The exhibit was divided into 18 quadrants measuring 2 quadrants deep, 3 quadrants in length, and 3 quadrants high. Each quadrant was approximately 125 cubic feet (5x5x5). However, the size of the quadrants varied slightly to fit in with the exhibit. The numbering of the quadrants started at the top, front, left quadrant and then proceeded down the column. The numbering then continued from the top of the column on the immediate right. After quadrant 9, located on the bottom, front, right quadrant, the number proceeded to quadrant 10, in the top, back, left corner, directly behind quadrant one. The numbering process continued as in the front section (quadrants 1-9).

Next, the social proximity of the two subjects was categorized according to the subject's nearness to other birds and recorded. The purpose this observation was to record the social interactions of the subject in

relation to both the other birds in the enclosure as well as the other hummingbird subject. The proximity of the subject to other birds was based on a 2 foot radius around the subject and further defined based on the following:

1. Subject is alone and not interacting/acknowledging other birds
2. Subject is alone, but is engaged in watching other birds
3. Subject is with a small group of bird (less than 3)
4. Subject is with a medium group of birds (3-7)
5. Subject is with a large group of birds (7+)

In addition to classifying the subject's general proximity to one another and the other birds in the exhibit, a count of aggression, which received or expressed the aggression, was recorded. This tally of aggression was gender neutral, as it was impossible to identify the gender of every bird without close examination of the bird's band. As a result, the bird's particular species

was used as classification instead.

The behavior of the subjects was also recorded. These behaviors were based on an ethogram (see addendum 1) of both known and observed behaviors. The ethogram was designed based on the priorities of behaviors, to eliminate the possibility of having 2 behaviors for one particular sample.

RESULTS

The total data for the location for *A. prevostii* shows little difference between morning and afternoon observations while in Free Flight. The location in isolation was not recorded since the size of the holding cage was smaller than one quadrant. However, there is a difference in the subject's location over the six week span of time in the Free Flight exhibit. Figure 2 shows a shift in the preference of location towards the beginning of week 3 from quadrant 10 to quadrant 11. The overall location for *C. coruscans* showed a consistent prefer-

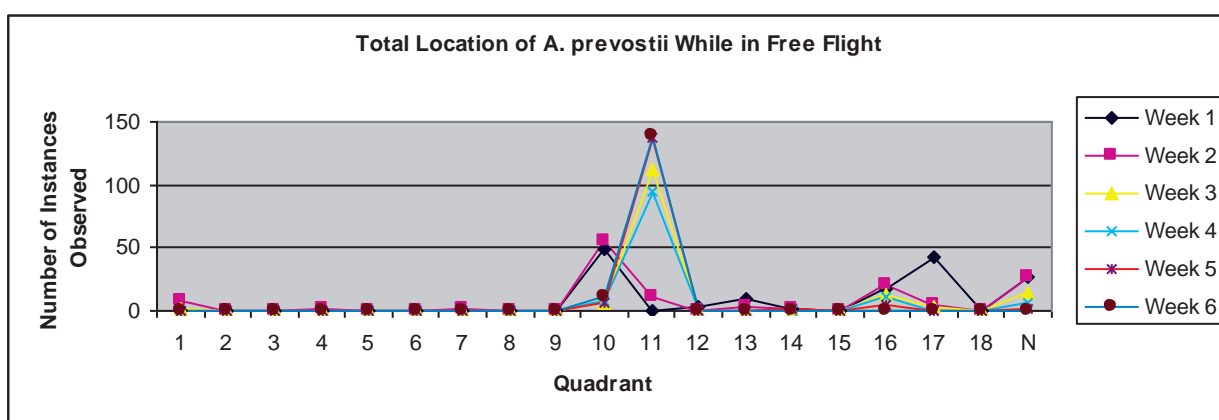


Figure 2. Total Location of *A. prevostii* While in Free Flight

Figure 2 is the data of both morning and afternoon observations on location for *A. prevostii* while in Free Flight. Figure 2 shows a clear transition in preference in location for quadrant 10 in weeks 1 and 2, to a preference of quadrant 11 in weeks 3, 4, 5, and 6.

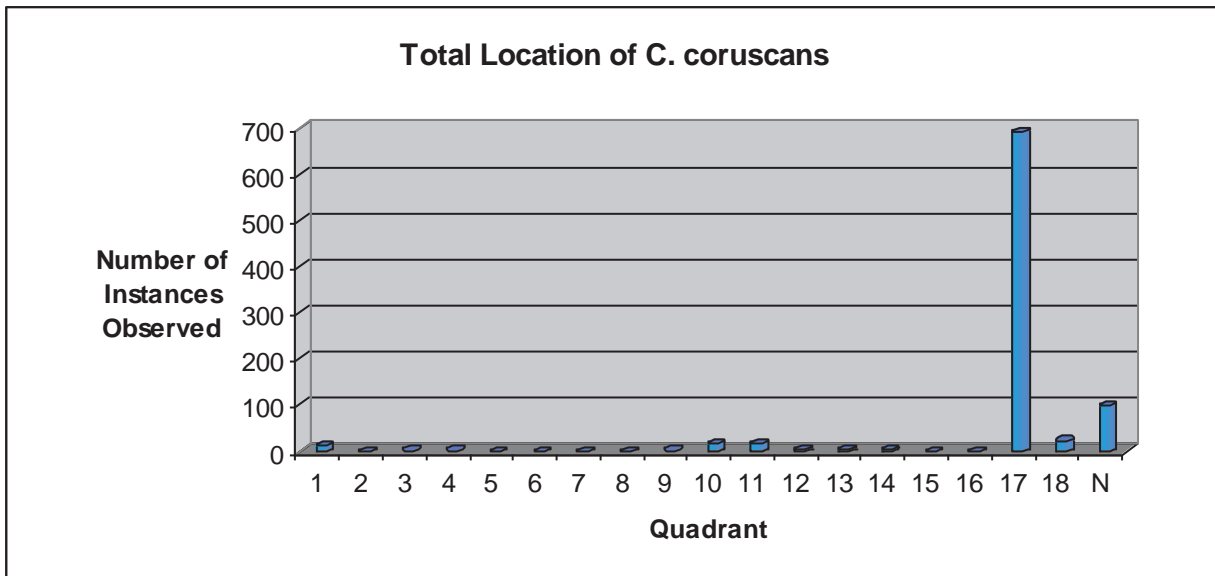


Figure 3. Total Location of *C. coruscans*

Figure 3 shows the location of *C. coruscans* while observed in Free Flight. Figure 3 shows the preference of *C. coruscans* of quadrant 17.

ence for quadrant 17 during both the morning and afternoon observations, as is seen in Figure 3.

The social proximity of both subjects was consistent. It comprised entirely of point 2 on the social proximity chart: “bird is alone, but is engaged in watching other birds.” Though usually isolated from other birds, both subjects received and initiated aggression with the other birds as seen in Figure 4 (next page). Figure 4 shows the number of instances of aggression received and initiated. *C. coruscans* was observed initiating more acts of aggression, especially against *A. prevostii*. *C. coruscans* also received less aggression than *A. prevostii*.

The behavior of *A. prevostii* showed no difference between the morning and afternoon observations. There was a difference, however, between the behaviors

noted while the subject was in isolation holding and, afterwards, in the Free Flight Aviary. As can be seen in Figure 5 (next page), there is a significant drop in the amount of perching behavior when in Free Flight as well as a slight decrease in the flying behavior compared to its behavior observed in isolation.

The behavior of *C. coruscans* was consistent. However, as can be see in Figure 6 (next page), certain behaviors were more prevalent depending on the time or location. Figure 6 shows that both fighting and bathing behaviors were only witnessed in Free Flight and in the morning. It also shows that behaviors such as feeding, grooming, fighting, and bathing were not seen, either in the morning or afternoon, while *C. coruscans* was in isolation.

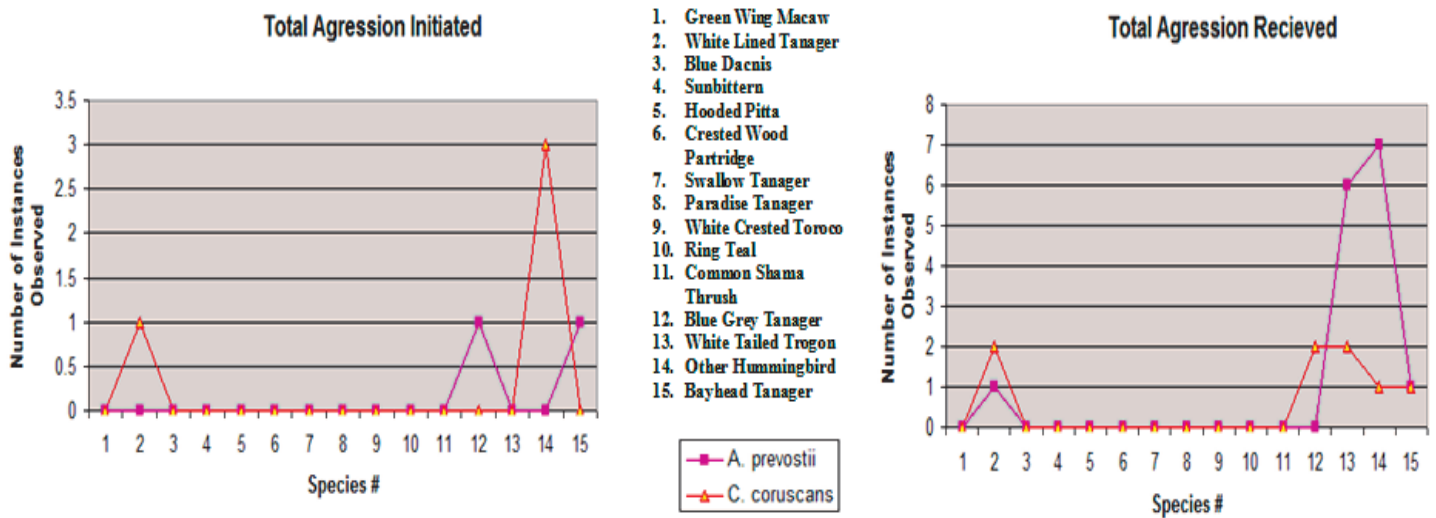


Figure 4. Total Aggression Initiated and Received by *A. prevostii* and *C. coruscans*

Figure 4 shows the number of observed instances of received and initiated aggression. It can be seen in the left portion of that *C.* initiated more instances of aggression, especially towards *A. prevostii*. The right portion shows that *A. prevostii* received more instances of aggression from other birds than *C. coruscans*.

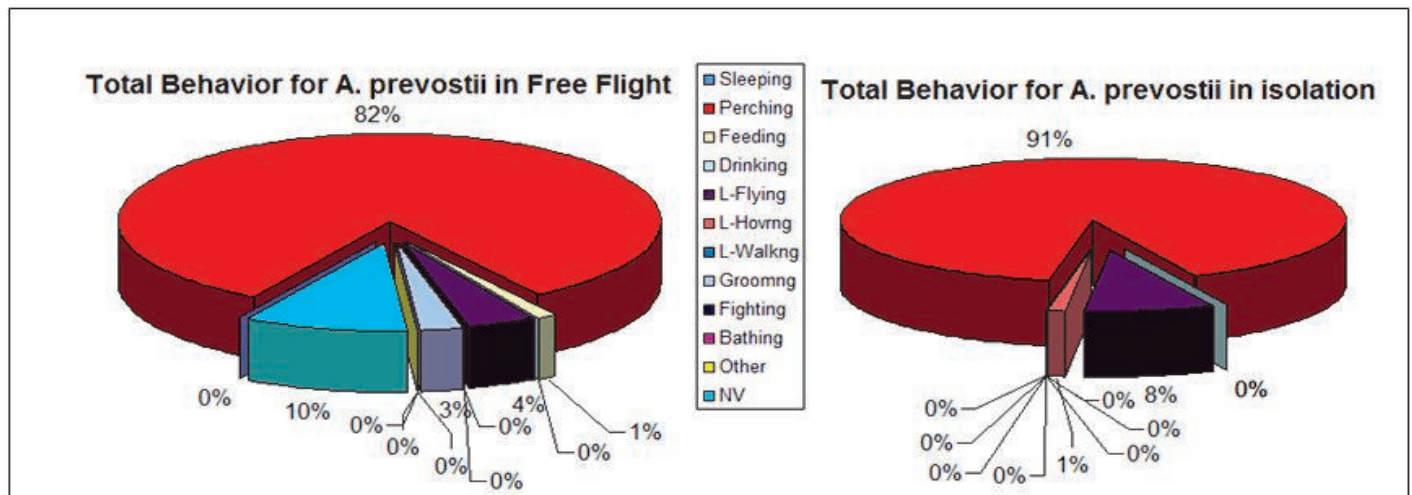


Figure 5. The Total Behavior of *A. prevostii* in both Free Flight and Isolation

Figure 5 shows the difference in total behavior from *A. prevostii* between the two environments: Free Flight, isolation. There is approximately a 10% decrease in the number of perching observations, as well as a 50% decrease in the number of flying observations.

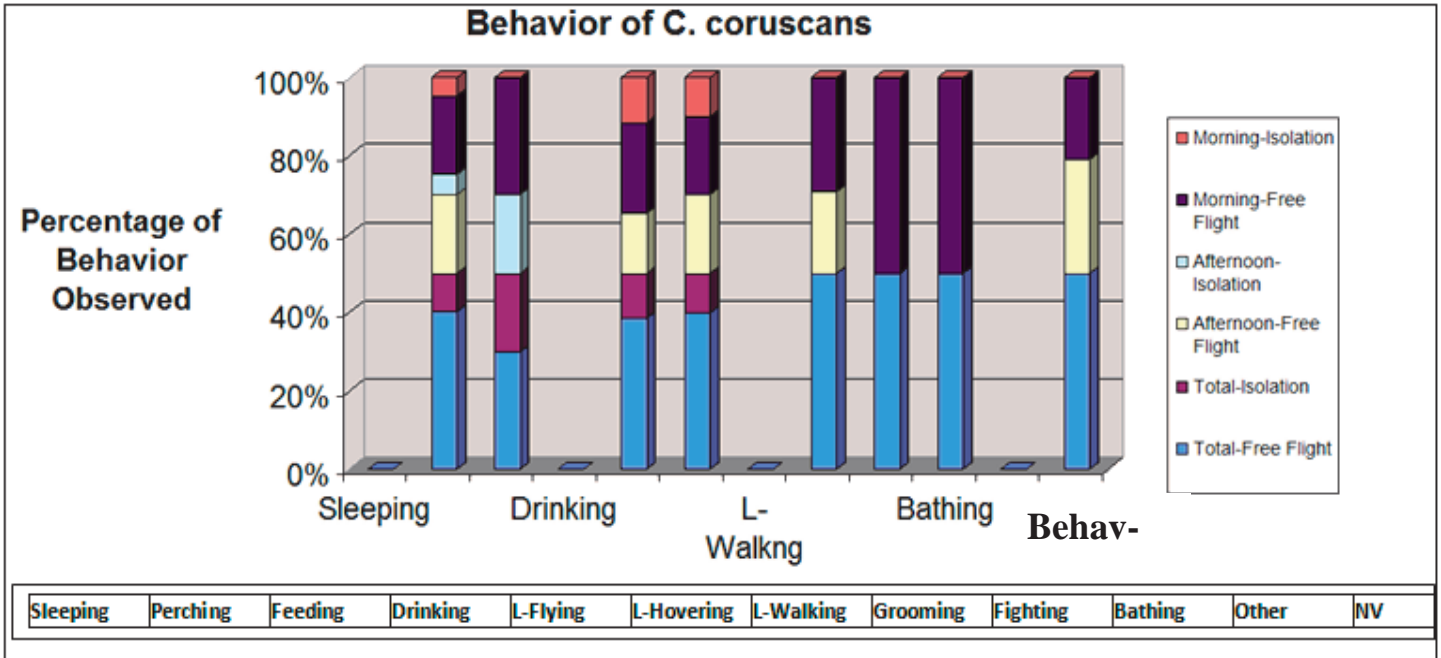


Figure 6. Behavior of *C. coruscans*

Figure is a stacked graph that shows the percentage of a behavior at a particular time. Figure 6 shows that certain behaviors are prevalent regardless of location or time, such as perching and flying. Other behaviors such as bathing, fighting, feeding, and grooming are only seen at certain times and only in Free Flight.

DISCUSSION

The location for both subjects was very specific. As illustrated in Figures 1 and 2, both subjects were prone to certain locations. Both subjects preferred to be in the back row, farthest away from public viewing and the keeper maintenance areas. This appears to demonstrate that both subjects prefer to be as far away from humans as possible.

A. prevostii initially preferred to be at the highest point of the exhibit (quadrant 11), and then moved to a lower position (quadrant 10). *A. prevostii*'s initial prevalent location could demonstrate an initial stress to the environment, the public (Demarset, Durrant, & Gibbons 1995), or other birds in the exhibit. Such a re-

sponse could explain the high vantage point. Gradual acclimation to the environment could be a possible explanation for its change in preferential location. The behavior of *A. prevostii* in the exhibit is comparable to its known behavior in the wild. High and open locations are known favorites of this species as they allow the bird to be vigilant and watch for potential predators.

C. coruscans demonstrated a clear preference for quadrant 17. This quadrant is in the right, middle of the back row and is mostly covered by plants and trees. The location where *C. coruscans* was most often observed was on a small branch within a tree. This sheltered location as well as the heightened aggression noted in Figure 4 could be indicative of its territorial nature. Such a behavior is similar to its known natural behavior.

Hummingbirds are known to be territorial, especially in regards to feeding locations (Carpenter, Hixon, Paton 1983).

The social proximities observed for both birds were that they were isolated from the other birds; however, they were still very observant of the birds around them. This also follows what is known about hummingbird behavior. Hummingbirds, in general, are known to be solitary when not breeding.

The behavior of both birds in isolation was relatively identical to the behavior they exhibited in the Free Flight Aviary. This similarity is most likely due to the fact that the temporary holding cages were not conducive to extensive movement of the hummingbirds. Such extensive movement may have been prevented due to cage obstructions.

In Free Flight, both birds were most often observed in a perched position. While both birds did fly for short periods of time, these rarely overlapped with observation times, reflected in Figure 6. This behavior is prevalent in hummingbirds since their rapid metabolism requires them to rest often. However perching for such long periods of time is probably uncommon. As a result, long periods of flight are probably uncommon. Hummingbirds are especially flighty and much more prone to flight as it is their only means of escape, especially as

their feet are ill-equipped to walk even short distances. This reoccurring behavior is most likely caused by captivity and prolonged exposure/close proximity to so many other birds. As both birds were confined to the same space as other birds, it appears that their behaviors tended to become more observant than evasive.

This experiment placed focus on the after affects of placing both subjects into a large aviary setting, Free Flight, in order to see the effects. This experiment was limited since it did not take into account several factors that could be the basis for future studies. These factors include the effects of people (public and keepers), the amount and distribution of light, concentration of nectar, as well as many others. These factors would provide even more information about these species.

In conclusion, the data shows a clear preference within the Free Flight exhibit. Both subjects demonstrated clear preferences in both location and behavior. The location varied for each hummingbird; however this agreed with the territorial nature of the type of bird. Perching was the predominant behavior for both birds. This behavior was probably a result of both natural instincts and adjusting to a captive environment. While both subjects were originally from the wild, both demonstrated some acclimation to their new environment, whether it was in location (for *A. prevostii*) or behavior (for both subjects).

ADDENDUM I: ETHOGRAM OF OBSERVED BEHAVIORS

1. Feeding	Subject is hovering with beak in nectar tube.
2. Drinking	Subject is perched or hovering with beak in water.
3. Locomotion-flying	Subject in flight (non-stationary)
4. Locomotion-hovering	Subject remains stationary while in flight.
5. Locomotion-walking	Subject moves along perch without flight
6. Fighting	Subject is engaged in violent aggressive behavior
7. Grooming	Subject manipulates feathers while perched.
8. Bathing	Subject places water on feathers or enters water.
9. Sleeping	Subject is perched and unaware/non-reactive to local environment
10. Perching	Subject was perched/otherwise inactive
11. Other	Subject performs a behavior not listed in this ethogram.
12. Not Visible	Subject cannot be seen at specific time

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A Genome Wide Search for Proteins that Control the Balance Between Proliferation and Differentiation in the *Drosophila* Ovary, an *in vivo* model System



-Avanti Jakatdar-

Avanti Jakatdar is currently a senior, pursuing a Bachelor of Science in Biology and a minor in German and Chemistry at Case. She has worked in an Orthopaedics lab and currently works in a Genetics lab at Case Western Reserve University's School of Medicine. This summer, Avanti participated in the Summer Program in Undergraduate Research, and she hopes to eventually pursue a degree in medicine. Besides research, she enjoys a capella music and is the director and president of Dhamakapella, Case Western Reserve's South Asian a capella group. She is also an avid classical dancer.

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I would like to thank L.S. Kulnane for her help in conducting the screen and collecting data, J. Chau and M.L. Johnson for figures and helpful discussions, and H.K Salz for introducing me to this project and mentoring.

ABSTRACT

Understanding how progenitor cells stop proliferating and enter a differentiation pathway is a fundamental question in cancer and stem cell research today. The long term goal of this study is to identify proteins required for the transition between proliferation and differentiation in the *Drosophila* ovary, which is a model system for studying stem cells and tumor formation. To meet this objective, gene trap technology was used, which involves the insertion of green fluorescence protein (GFP) via a P element transposon called P{GFP}. When P{GFP} is inserted into an intron, it 'traps' the protein and functions as an exon, fusing the endogenous protein with GFP. This GFP fusion protein allows for examination of the expression pattern of the trapped gene *in vivo*. Transgenic lines that contain single random P{GFP} insertions are identified using our genetic screening.

Live ovaries were screened to identify patterns of GFP expression in the transgenic lines. Thus far, over 300 lines were screened and two were identified that express GFP. By searching for genes that are highly expressed in tumor cells, the probability of trapping interesting genes was increased in proliferating or differentiating cells. High resolution microscopy was used to determine if GFP expression is occurring in stem cells or differentiating cells and also to compare expression in wild type ovaries to tumorous ovaries. Inverse PCR and sequencing was used to identify the endogenous gene in which the GFP insertion has occurred. Knowing the identity of the trapped protein will lay the foundation for understanding the role of the protein in the pathway that controls the choice between proliferation and differentiation.

INTRODUCTION

Stem cells are undifferentiated cells that undergo asymmetric division to produce a daughter cell that remains a stem cell and proliferates, and a progenitor cell, whose progeny differentiate into a defined cell type. Progenitor cells undergo limited cell division in the time between leaving the stem cell niche and beginning differentiation, and can sometimes 'de-differentiate' to regain the stem cell's self renewing properties. The regaining of stem cell-like self-renewing properties is thought to be a characteristic of tumorous cells.

The model used for the study of stem cells and tumor development is the *Drosophila melanogaster* ovary (Figure 1, provided by Johnie Chau). The ovary consists of 15-20 tubes called ovarioles. Two or three germline stem cells (GSCs) are located in the germarium, the anterior end of the ovariole. The daughter cell that remains in contact with the somatic cap cells at the tip of the germarium remains a stem cell and the other daughter cell, the progenitor or cystoblast (CB) cell, undergoes cell division.

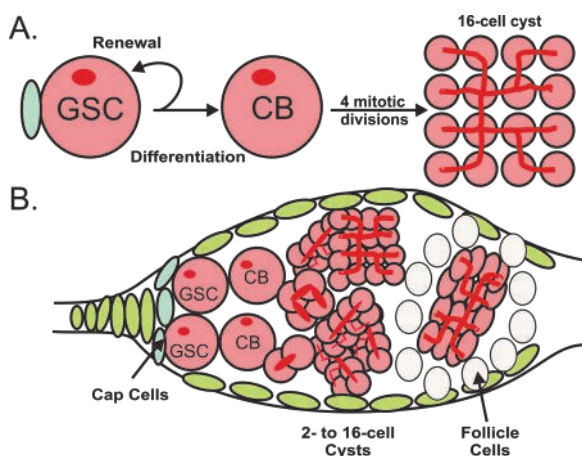


Figure 1. Our *in vivo* model system: the *Drosophila* ovary

The fly has proven to be a good model for gene identification and function studies. The simple anatomy of the fly germline allows for unambiguous identification of stem cells and their progeny *in vivo*. Also, results can be directly applied to human stem cell biology because the stem cell system appears to be conserved between flies and vertebrates.

The genetic screen that was carried out is designed around two main points. First, control of germ cell fate decisions occurs at both the transcriptional and post translational level, and the study therefore uses 'protein trapping' rather than expression arrays. Second, it is known that the proliferation/differentiation decision is made by stem cell-like cells as they leave the stem cell niche, but it is impossible to screen for genes expressed specifically in these cells because there are only a few in each ovariole at any given time. We screen instead for genes expressed in the *snf^{d48}* tumor cells, as studies conducted in Dr. Salz's lab indicate that *snf^{d48}* tumors are rich in stem cell-like cells arrested in an intermediate stage of development. By comparing GFP expression in tumorous and wild types ovaries, lines that express GFP specifically in these arrested, intermediate cells but not differentiating cells can be identified. Proteins that are ectopically expressed in tumor cells may be coded by genes that must be silenced in order for differentiation to proceed. That is, these genes may be responsible for the continued proliferation in tumor cells, and further studies will show how exactly these genes function in the proliferation/differentiation decision.

To identify genes expressed in *snf* tumors, a collection of lines that contain single, random insertions of GFP were generated and screened. The screen is based

on other successful models that used the P-element based protein trap transposon called P{GFP}, which contains an artificial exon encoding GFP flanked by splice site acceptor and donor sequences (Morin, X., R. Daneman, M. Zavortink, and W. Chia, 2001). It functions as an exon when inserted into an intron fusing the endogenous protein with GFP. P{GFP} can also function as an enhancer/gene trap and in most cases, GFP expression accurately reproduces the developmental expression pattern of the trapped gene (Buszcak M, Paterno S, Lighthouse D, Bachman J, Planck J, et al., 2007).

The process of gene trapping is shown in Figure 2, provided by Dr. Salz. Other researchers in Dr. Salz's lab had already identified two lines that are expressed in the intermediate cells, and more lines expressing GFP are being trapped and identified using the screen.

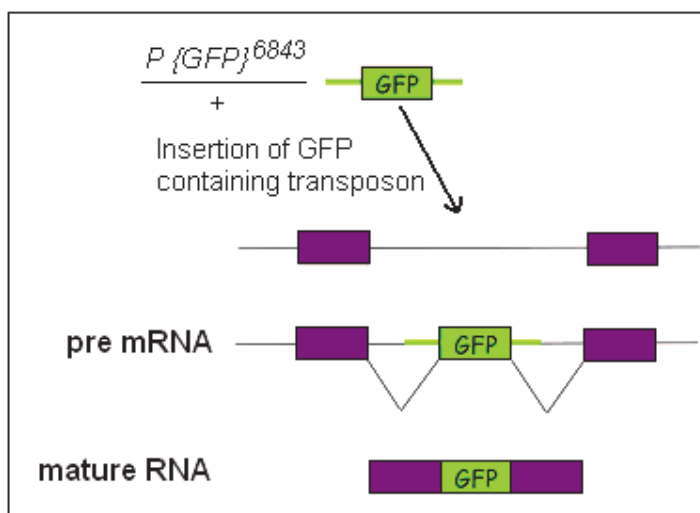


Figure 2. Trapping genes with a GFP exon

MATERIALS AND METHODS

Unfixed, dissected ovaries were screened directly for naturally fluorescent GFP expression. The ovaries were from females containing the P{GFP} insertion. Possible expression patterns that could have been detected are shown below (Fig. 3, provided by Johnie Chau).

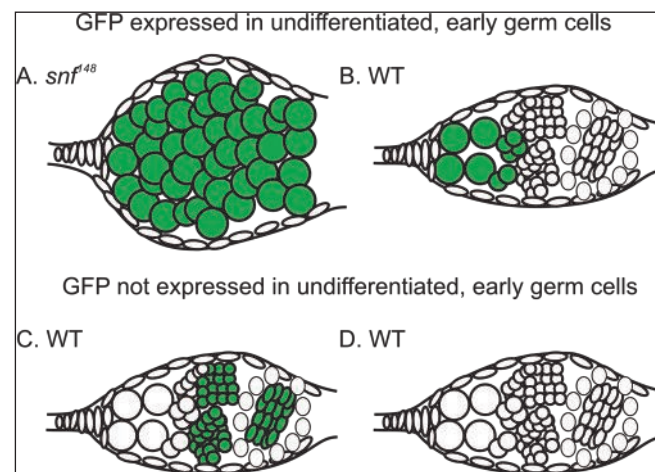


Figure 3. Possible GFP expression patterns.

A) *snf⁴⁸* ovaries were screened for GFP expression throughout the germline. B-D) Expression patterns that could have been detected in wild type ovaries are B) expression in undifferentiated, early germ cells, C) expression in differentiated cells and D) no expression in the germline

To generate lines containing a single GFP insertion, different genotypes of flies were selected and mated based on eye color and shape until females with the insertion were obtained. First, males containing the P{GFP} transposon and transposase were mated to females homozygous for *snf⁴⁸*. Progeny in which the transposon had jumped to an autosome were then selected and mated to homozygous *snf⁴⁸* females. Finally, females with the insertion were selected and screened for GFP expression. The screen is shown to the right in a figure

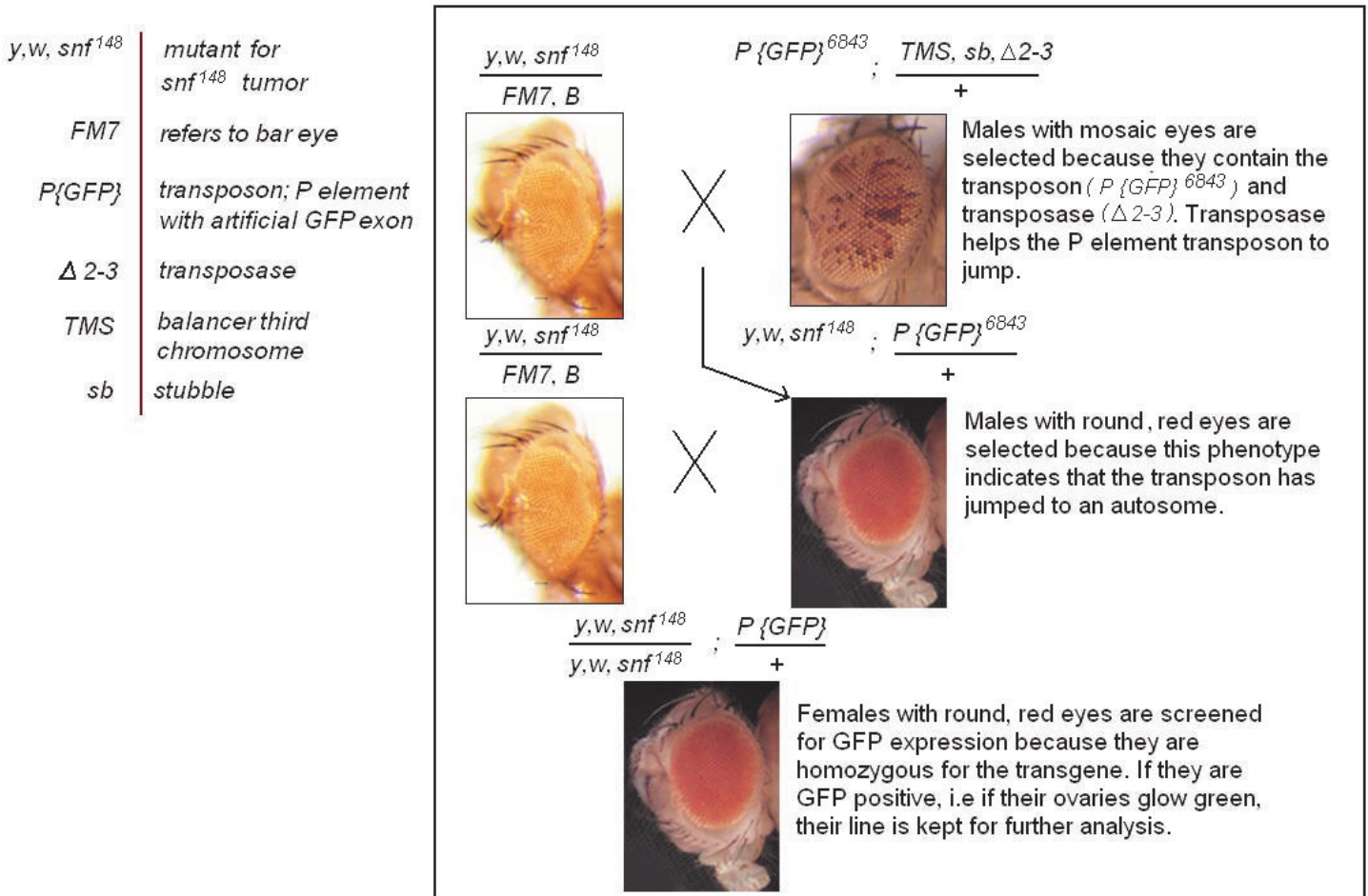


Figure 4. The GFP Screen

created by the author. Once a line expressing GFP was identified, the line was expanded to obtain a sufficient number of flies for confocal microscopy and inverse PCR.

Confocal Microscopy

10 wild type flies and 10 mutants were selected from each GFP positive line in order to compare expression in wild type and tumorous ovaries. A three day antibody staining procedure with rabbit anti-GFP was applied to increase GFP expression for easier identification of expression patterns in the ovary. Slides were prepared by teasing apart the ovarioles and fixing them in *Vec-*

tashield Mounting Medium. High resolution microscopy was then used to capture images of GFP expression in the ovarioles.

Inverse PCR

To locate the protein-trap insertion, the DNA flanking the insertion was recovered and sequenced using inverse PCR. The process of inverse PCR is shown in figure 5 (next page), provided by Johnie Chau. DNA was extracted from 30 mutants per line by treating them with buffer, a LiCl/KAc solution and TE. Then the DNA was digested with restriction enzymes *HinP1* and *Msp1*. The transposon was ligated to the endogenous DNA using

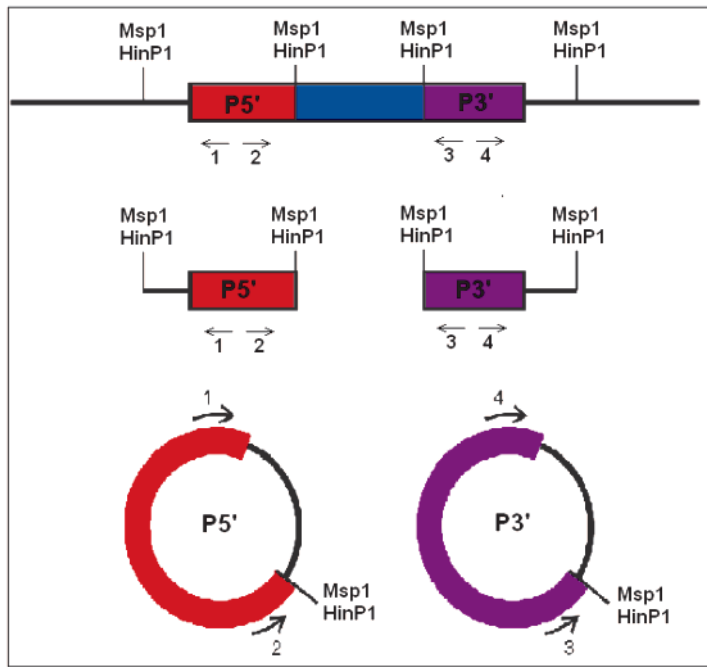


Figure 5. Inverse PCR.

1. Genomic DNA from a P{GFP} line is digested with restriction enzyme MspI or HinPI.
2. Fragments are made to self-ligate using T4 ligase.
3. 1-4 listed by the small arrows are the primers; red and purple bars represent ends of the transposon; black line represents endogenous DNA sequence.

ligation buffer and T4 Ligase. Finally, inverse PCR was performed with Pwht1 and Plac1 as 5' primers and Pry4 and Pry1 as 3' primers.

Gel Electrophoresis

This procedure was used to determine if the PCR products would be sufficient for obtaining good sequencing results. A 1.2% agarose gel was used to run the samples and the 100 bp marker.

BLAST

By analyzing the sequencing results, the endogenous gene was identified by its presence between the P{GFP} transposon and the restriction site. BLAST alignments were performed on the endogenous sequence and the *Drosophila* genome to identify the location of the insertion within the genome.

RESULTS

Confocal Microscopy

Shown to the right are high resolution pictures of lines that were used (Figure 6).

Inverse PCR and Gel electrophoresis

Shown to the right are results from the inverse PCR of lines LSK 1261 and 1335 (Figure 7). The products are different in size because they were digested with different restriction enzymes, either MspI or HinPI.

BLAST

Sequencing results from PCR products showed the location of the transposon and the restriction site, whose sequences are known. In between the two was the sequence of the endogenous gene. Aligning the endogenous gene with the *Drosophila* genome showed us the approximate location of the gene within the genome. The 5' PCR product of LSK1093 digested with MspI

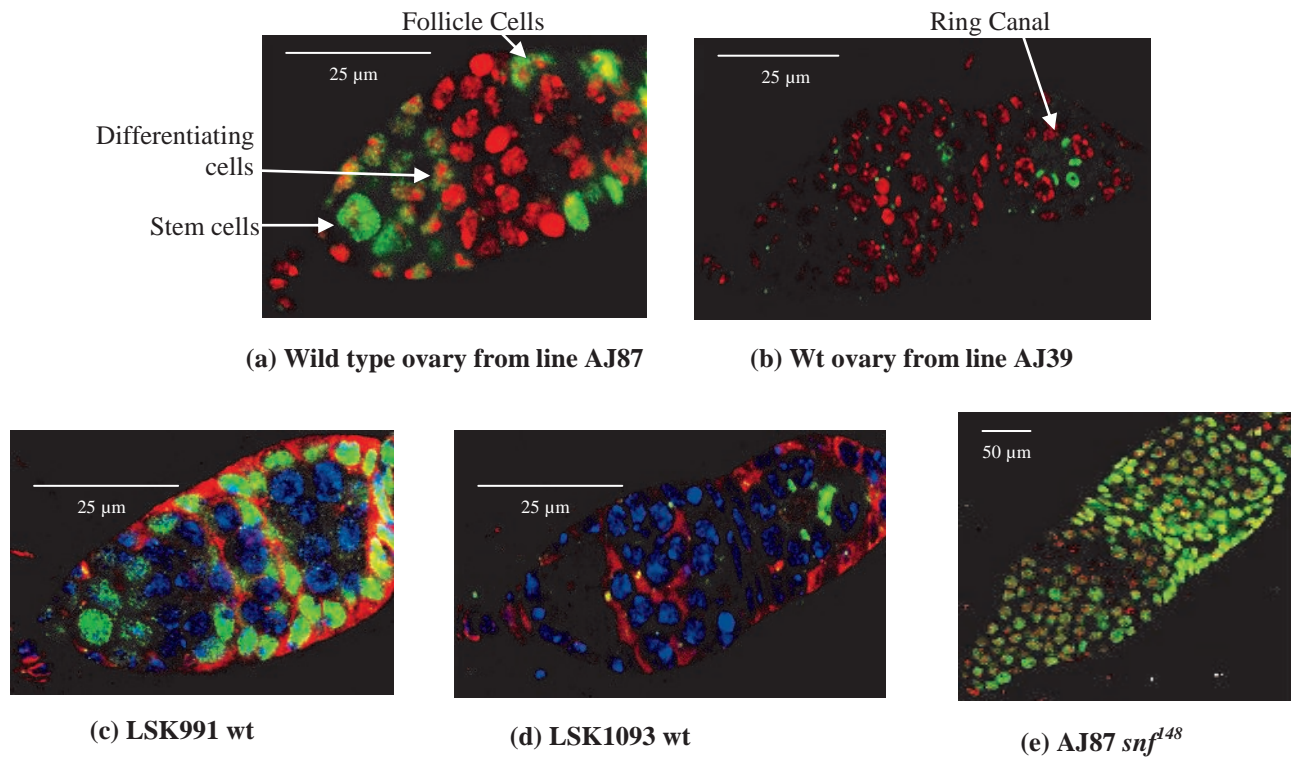


Figure 6. Confocal Imaging a) Wild type ovary from line AJ87. GFP expression is seen in the stem cells in the germarium, and in the follicle cells, b) Wt ovary from line AJ39. GFP expression is seen in ring canals, the region where interconnected germ cells connect, c) Wt ovary from LSK991. GFP expression is seen in the stem cells and follicle cells, d) Wt ovary from LSK1093. GFP expression is seen in the ring canals, e) Tumorous ovary from AJ87. Strong GFP expression is seen throughout the ovary. In (a), (b) and (e), DNA is colored red and GFP is green. In (c) and (d), DNA is colored blue and GFP is green, and 1B1 antibody causes the red color.

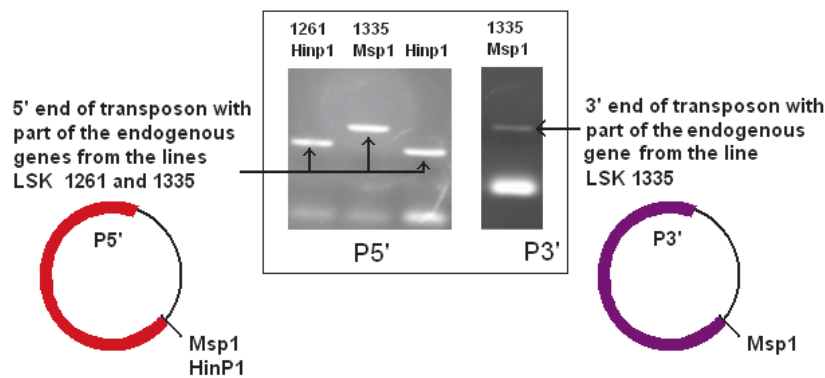


Figure 7. Inverse PCR. On the left are results obtained from 5' PCR primers Wht1 and Plac1. On the right are results from 3' PCR primers Pry4 and Pry1. The bright bands at the bottom of the gel are most likely primer dimers.

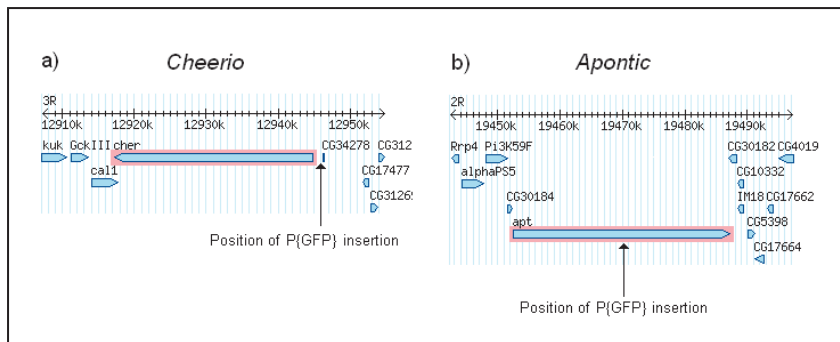


Figure 8. Location of the endogenous gene

A) from line LSK1093, digested with MspI

B) from line LSK991, digested with HinPI

aligned with a region outside the 5' region of the 'Cheerio' gene. The 5' product of LSK991 digested with HinPI aligned with part of the sequence of the 'Apontic' gene. The approximate locations of the P element insertions are shown above (Figure 8).

In the mutant AJ87, GFP expression was seen throughout the ovary (Figure 6), in the stem cell-like cells arrested in an intermediate stage of development. This may show that the 'trapped' protein is involved in arresting differentiation and restarting proliferation. GFP expression was seen in proliferating germ cells in the AJ87 and LSK991 wild types, which may show that the trapped protein has a role in early germ cell proliferation. Although the intention of the screening was to identify expression in proliferating cells, expression was unexpectedly found in ring canals in AJ39 and LSK 1093. Ring canals are cytoplasmic bridges that allow the flow of nutrients from nurse cells to oocytes. They are necessary for proper oocyte and egg chamber formation (Robinson D.N, Cant, K and Cooley, L., 1994). Therefore, expression in the ring canals may show that the trapped protein is involved in differentiation and proper cell development.

In LSK991, the GFP insertion occurred in Apontic, which is thought to be involved in transcriptional activity, mRNA binding and DNA binding. This gene may not be directly involved in stem cell proliferation. Cheerio is known to be involved in ring canal formation, but ring canals may only be required for proper differentiation and not for making the transition between proliferation and differentiation. Therefore, Cheerio may not have a direct role in controlling the balance between proliferation and differentiation.

Sequencing of lines AJ87 and AJ 39 is currently in progress, and it will be interesting to see if the insertions occurred in Cheerio and Apontic, as the expression patterns in AJ87 and AJ39 are consistent with LSK991 and LSK1093 respectively. The goal was to find genes that are highly expressed in tumor cells and may play a role in the stem cell's decision to proliferate or differentiate. In all four lines, GFP was highly expressed in tumor cells, and looking at expression patterns in the wild type offered a clue as to what type of role the trapped protein may have. Further analysis to determine the identity of the trapped proteins will lay the groundwork for understanding their role in the pathway that controls the choice between proliferation and differentiation.

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Turning Behaviors in the Cockroach *Blaberus discoidalis*



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INTRODUCTION

Legged insects are able to traverse a wide range of unpredictable terrain and assess their surroundings by responding to sensory input absorbed through their eyes and antennae. When an antenna comes into contact with an obstacle, the cockroach changes gait patterns accordingly to navigate around the obstacle (Mu, 2005). In this study, discrete electrolytic lesions were used to assess the role of various regions in the brain in completing complex obstacle negotiation behaviors. One region in particular, the central complex, is of interest because it has been shown to have antennal inputs as well as effects on motor control (Ridgel et al 2007). Cockroaches were tested on a vertical and horizontal track in order to examine the differences in turning on a flat horizontal surface and turning on a vertical surface. Preliminary data suggests that lesions to the central complex result in turning deficits on both flat and vertical surfaces.

MATERIALS AND METHODS

Animals

Adult *Blaberus discoidalis* cockroaches were housed in small colonies in a twenty liter bucket. These were maintained in a 12-12 hour light-dark cycle at 25°C. Animals had ad libitum access to water and dry food in the form of chicken feed. Both male and female animals were used in these experiments.

Horizontal climbing apparatus

Cockroaches walked through a U-shaped turn made of Plexiglas. The turn was placed on a glass plane with a mirror at a 45° angle below it to reflect images for video recording.

Vertical climbing apparatus

The same Plexiglas U-shaped turn used in the horizontal climbing apparatus was mounted on a square wooden frame. The frame had a plastic screen stretched underneath the Plexiglas structure, which the cockroaches used to climb.

Preparation and surgery

Intact animals were taken and anesthetized with exposure to sub-zero temperatures for five to eight minutes. Their abdomens were then painted white with White-Out pen to aid in viewing their leg movements. Individuals were given at least one hour to recover. They were then run through the horizontal and vertical turns in order to determine each individual's normal behavior. After initial tests were completed, the cockroaches were anesthetized with cold again for five to eight minutes and placed into a stabilizing tube to prevent their heads from moving. Using a fine razor blade, the brain was exposed and a steel probe was inserted into the brain. A current of approximately 1.3 mA was applied for 30 seconds, and then wax was used to secure the removed exoskeleton to the head. All insects were given at least 24 hours to recover from surgery.

Histology

Following the procedures of Ridgel et. al. 2007, the heads of each animal were removed after post-lesion

tests were completed, then the brain was removed, and fixed in AAF (85% ethanol, 5% acetic acid, 10% formaldehyde). The brains were then dehydrated in graded ethanol series and embedded in Paraplast Plus (Fisher). Tissue blocks were sectioned at 12 µm and stained with 1% toluidine blue. Sections were then viewed with a conventional light microscope.

Data analysis

All videos were analyzed using WinAnalyze motion analysis software (Mikromak, Berlin). Videos were analyzed frame-by-frame and each trial was labeled either normal or abnormal based on pre-tests done with intact animals. Abnormal behaviors were defined as a permanent change in behavior from behaviors exhibited in the pre-lesion tests.

RESULTS

Lesion locations

Of all the cockroaches tested, only four generated data suitable for analysis. The cockroaches had lesions on the top of the fan body, near the fan body, outside the central complex, and a sham as depicted in figure 1.

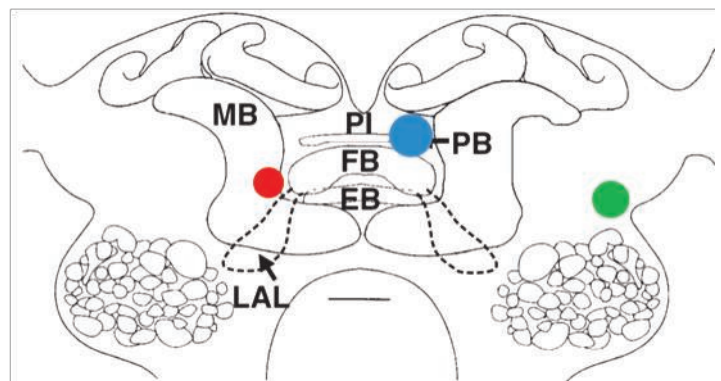


Figure 1. Drawing of the different locations of lesions. FB is the fan-shaped body, PB is the Protocerebral bridge, EB is the Ellipsoid body, MB is the Mushroom body, LAL is the Lateral accessory lobe, and PI is the Pars intercerebralis.

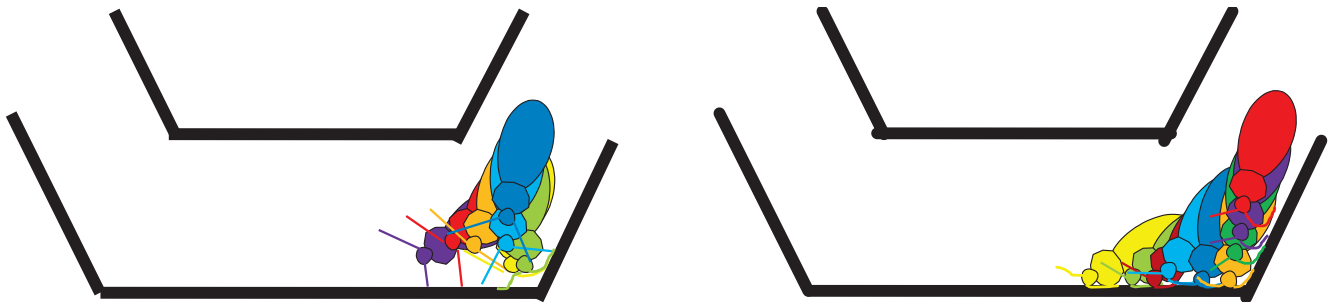


Figure 2. Tracings of a cockroach going through a horizontal turn. The left picture shows a pre-lesion insect making antennal contact with a wall and responding to the sensory input. The right picture is a post-lesion insect that has no response to antennal contact with the wall and consequently only turns once its head comes into contact with the wall.

Turning behaviors

Abnormal turns were defined as a distinct change from an animal's pre-lesion behavior. Figure 2 is an example of an abnormal turn. The main difference was the lack of response to antennal feedback that resulted in the animal hitting the wall before turning. On both the horizontal and vertical turns, those cockroaches with lesions closer to the central complex were the source of a higher percentage of abnormal turns, see figure 3. The cockroach that had a lesion right above the fan-shaped body had an almost one hundred percent increase in abnormal turning behaviors. The lesion that was close to the central complex was approximately 52nm away, resulting in

small increases in abnormal turning behavior. In the case of the lesion that was completely outside the central complex, the behavior patterns were similar to a sham. On the vertical turn, individuals often did not move which may be a result of a more difficult obstacle.

DISCUSSION

Sensory input is extremely important in decision making for animals when they approach unfamiliar obstacles. By disrupting the flow of sensory information through the use of discrete lesions we can generate abnormal behaviors. The resulting behaviors and their severity are

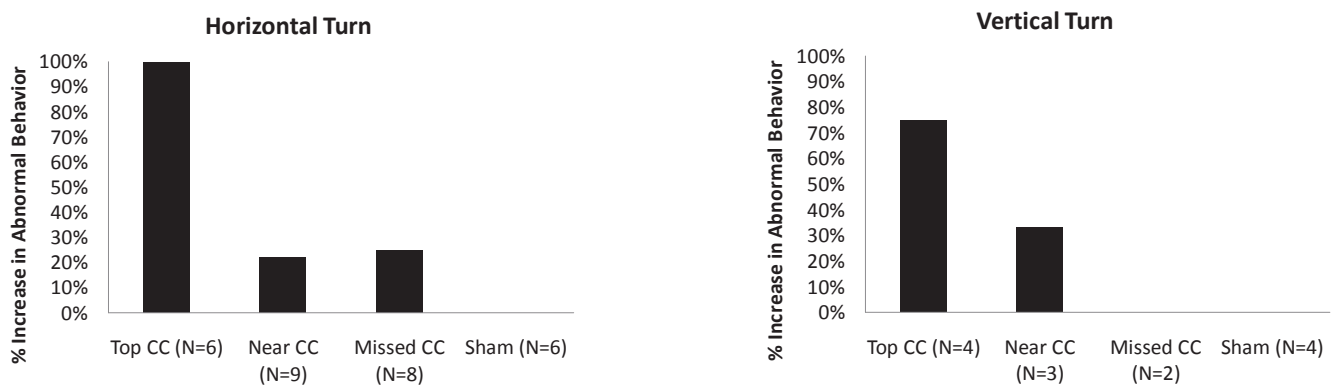


Figure 3. Summary of the percent increase of abnormal behaviors depending on location of lesion and which obstacle the cockroach navigated. CC is the central complex.

the result of lesion size and location of the lesion. Discrete lesions closer to the central complex resulted in a larger percentage of abnormal behaviors. The insect that had the lesion at the top of the central complex in the protocerebral bridge had an almost one hundred percent increase in abnormal behaviors. The protocerebral bridge is responsible for compensating in differences in left-right motor responses, and therefore regulating the swing-stance phases during turning (Strausfeld 1999). Sensory information from the legs offsets the effects of the lesion in the protocerebral bridge when the cockroaches came in contact with the wall. This feedback then caused the cockroach to turn, much like it did when it hit its head on the wall on the horizontal turn, lowering the level of abnormality on the vertical turn. The insect with a lesion completely outside of the central complex exhibited behaviors similar to a sham. In addition, the lesioned insects seemed reluctant to climb on

the vertical turn. This could be the result of the inability to climb from lack of sensory input, or it may be a result of the lesioning process. However, once the insect managed to get on the screen, it was still able to climb. The overall conclusion made is that the closer a discrete lesion is to the central complex, the greater the increase in abnormal turning behaviors. It should be noted, again, that the insect is still able to navigate a vertical surface.

Future Studies

Because of the small sample size, this is merely a preliminary study. Conclusions about the effects of discrete lesions on the turns cannot be made with such little supporting evidence. By increasing the number of trials, we can make clearer conclusions about the effects of lesions on horizontal versus vertical turning. By localizing the lesions to a specific area, we can also increase the statistical significance of any findings made.

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Covariation in Limb-Limb and Limb-trunk Proportions in Whites and Blacks and Males in Females using the Hamann-Todd Collection, Cleveland Museum of Natural History



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INTRODUCTION

Stature estimation is traditionally an important consideration in physical anthropology and archaeology and is especially pertinent in the realm of forensics. The most widely used resource for estimating living stature from the length of long bones is the research of Trotter and Gleser (1952) (White, 2000). They studied the relationship between bone length and stature of American Blacks and Whites¹ from the Terry Collection at the National Museum of Natural History. They also used records of the casualties from the Korean War (Trotter and Gleser, 1952). Their research is an important basis for the exploration of diversity within and between populations. Several other researchers have found variation in stature and limb proportions across many populations throughout the world. In a Croatian sample, Petrovecki et al. (2007) found that the humerus is the most accurate predictor of stature in females, and the tibia in males. Mendonca (2000) found that in a modern Portuguese population, the femur yields a better estimate for stature than the humerus, but these were the only two bones measured in this study. Radionova et al. (2002) found that the formulae provided by Trotter and Gleser do not describe the modern day Bulgarian population based on measurements of stature, the humerus, tibia and fibula. Steyn and Smith (2007) found significant differences among the statures of three South African populations; South African Whites (no African ancestry) are taller in both sexes than South African Blacks and South Africans of both European and African ancestry; however both groups with either all or some African ancestry are closer to each other

¹ The terms 'White' and 'Black' are used in the American context from the beginning of the 20th century.

than to the Whites. Celbis and Agritmis (2006) found that, among all long bones, the femur gives the best estimate of stature. Generally the order of correlation between length and stature from highest to lowest is: femur, tibia, fibula and the humerus (Hauser et al., 2005). However, this could be different in different genetic or chronological populations.

Aside from differences between populations and regions, secular changes in overall stature and limb/stature proportions distort the reliability of the original data on modern populations (Jantz, 1992; Gordon-Larsen et al., 1997; Ruff, 1994; Katzmarzyk and Malina, 1999, Hauser et al., 2005; Silventoinen, 2003). Genetics only play a part of the role in stature and allometric variation; environment contributes to about 20% of stature in the United States and Finland (Stunkard et al., 1986; Silventoinen, 2003). Jantz (1992) found that the femur-tibia proportion in Whites from the Forensic Anthropology Data Bank has decreased over time; modern Whites have longer shins compared to thighs than they have in the past. Conversely, the ratio has stayed the same in Blacks. Pretty et al. (1998) found that stature has been stable among the South Australian Aboriginal Murraylands. Duyar and Pelin (2003) found that there are different femur-tibia ratios among different groups based on stature and that the ratio increases as height increases.

In every population, mean male stature is greater than mean female stature, but the degree of sexual dimorphism varies across populations (Holden and Mace, 1999). Holliday and Ruff (2001) found that the proximal limb segments (femur and humerus) tend to be more stable across populations compared to stature than the distal limb segments (tibia, fibula, ulna and radius).

Males have a greater range of variance than females; both upper and lower distal limbs vary to the same degree in females, whereas in males the lower legs have a greater range than the lower arms. According to this phenomenon, it would seem that one would need to know the sex and race of the individual prior to estimation the stature. Iscan and Shihai (1995) found the knee to be more sexually dimorphic in the Chinese whereas the pelvis is more dimorphic in American Whites and Blacks. Overall, sexual dimorphism is best delineated with breadth and circumference measurements rather than total length of long bones. Determining sex via osteoscopic evaluation can yield an accuracy rate as high as 100%, as long as the evaluator understands sexual dimorphism in different populations (Iscan, 2005). Chibba and Bidmos (2007) found sexual dimorphism in the tibia of White South Africans with a wide variety of European descent. Stature could be best predicted in male tibiae by measuring the breadth of the proximal end, whereas in females, the breadth of the distal end is the most accurate. Asala et al. (2004) found that the part of the femur which contributes most to sexual dimorphism is the vertical diameter of the femoral head, with men having a larger diameter than women. In the distal end of the femur, the medial condylar length is longer in males than in females. Overall, the accuracy of this procedure ranges from 81.5 – 85.1%. Mall et al. (2001) found that in a sample of German men and women, the vertical diameter of the humeral head is the most (90%) accurate in determining sex.

Several researchers have also attempted to apply modern-day stature estimation techniques to archaeological populations. Zakrzewski (2003) found a significant increase in stature in ancient Egyptians, which co-

incided with an increase in societal hierarchy and a dependence on agriculture from ca. 4000 BC to ca. 1900 BC. A greater increase was found in males than in females. Interestingly, there was an increase in all long-bone length except for the fibula. There was also a significant decrease in the maximum length of the humerus relative to the ulna through time, indicating the adaptation of a more African body plan. Raxter et al. (2008) reconstructed stature on an ancient Egyptian population by using a revision of the Fully technique (Raxter et al., 2006). They found that ancient Egyptian body proportions were closer to modern American Blacks than to Whites, but not identical (Raxter et al., 2008). Giannecchini and Moggi-Cecchi (2008) found that stature fluctuated over time in three archaeological Italian samples; the lengths of the distal limb segments were more pronounced than the proximal limb segments.

Sometimes the best evidence left behind at a crime scene or an archaeological site are fragmentary remains of long bones, in which case the bone would need to be reconstructed before one could apply a stature-regression formula. The Steele method was developed in the 1960's to reconstruct the length of long bones based on portions on the bone (Steele and McKern, 1969). Simmons et al. (1990) revised this method by defining specific landmarks which made it more feasible and accurate for other scientists to repeat the procedure. Holland (1992) also found a significant correlation between the proximal end of the tibia and stature, although the distal or mid-portions were not measured. It is important to note that using the proximal end of the tibia, or any fragment of a bone, should be used only in the absence of complete bones. The errors of estimate compound when stature is estimated by us-

ing an estimate of a long bone measurement.

In this study, I will explore the co-variation of limb and trunk proportions in American Blacks and Whites. I will also test the reliability of the Trotter and Gleser (1952) stature estimation formulae to a sample from the Hamann-Todd Collection at the Cleveland Museum of Natural History.

METHODS AND MATERIALS

Bones were collected from a total of 126 individuals representing four American populations that died between the years of 1912-1938 from the Hamann-Todd collection at the Cleveland Museum of Natural History (henceforth will be referred to as CMNH). Groups were divided into the following subgroups: 30 Black females; 32 Black males; 33 White females; 31 White males; all females; all males; all Blacks; and all Whites. Only non-pathological specimens between the ages of 20 and 55 years were chosen with no obvious distortion in the maximum or physiological lengths. All of the long bones were taken from the right side of the body unless there was damage or deformities, in which case the left side was used.

All twelve thoracic and all five lumbar vertebrae needed to be present in order to be included in the study. All of the long bones were measured for maximal height using a standard osteometric board. The femur's bi-condylar length was measured by placing both condyles against the base and marking the maximum spot on the head of the femur. Maximal lengths were taken for the rest of the long bones. The trunk was divided into a thoracic region and a lumbar region. Each region was then measured by adding the anterior vertebral heights of the

respective section. The anterior vertebral height was measured using a digital sliding caliper. All measurements were in centimeters; those of the long bones were rounded to the nearest tenth, and those of the vertebrae were rounded to the nearest hundredth. According to the written records provided by the CMNH, the living stature was measured post-mortem on the cadavers by hanging the body vertically with the feet flat on the floor.

All four limb segments were represented by their corresponding long bones: the femur is the thigh, the tibia and fibula are the shin, the humerus is the upper arm, and the ulna and radius are the lower arm. Both bones of each distal limb were included to test for any significant difference between the two. Comparisons were made between the leg (femur and tibia) and the trunk, as well as the arm (humerus and ulna) and trunk. Finally, comparisons were made between true stature (HT, as measured by Todd) and predicted stature (TG, using the formulae provided by Trotter and Gleser, 1952). The stature measured by Todd is considered to be equivalent to living statures (Dupertuis and Hadden, 1951). The statistical calculations made were: bias, inaccuracy, mean, standard deviation, variance, least squares regression, and the simple t-test for both one sample and two samples. Bias is defined as directional error from zero; inaccuracy is defined as the magnitude of error. The α -level was set at 0.01.²

RESULTS

The mean, standard deviation and variance are plotted in Table 1 for age and bone lengths. On average, I over-measured the long bones by 0.4 mm (0.1%); the inaccu-

racy was 0.6 mm (0.2%). I tended to over-measure the vertebral heights by 0.05 mm (0.2%) with an inaccuracy of 0.2 mm (0.9%). The greatest inaccuracy was in the tibia (1.6 mm.) and the least in the fibula and humerus (0.3 mm.). The greatest amount of bias was in the tibia (0.6 mm) and the least in the fibula and humerus (0.3 mm.). See Table 2 for intraobserver bias and inaccuracy.

There was significant correlation between the lengths of each long bone to one another. There was a highly significant correlation between the tibia and the fibula, and also between the ulna and the radius. In order to avoid redundancy, only the tibia was used to represent the distal lower limb segment, and only the ulna was used to represent the distal upper limb segment. There was significant correlation between the limb segments and the length of the trunk when the subgroups were divided based on race, but not when the subgroups were divided based on sex. For the population as a whole, there was significant correlation between the lengths of the long bones and the length of the trunk. White males showed significant correlation between the length of the femur and the length of the trunk, as well as the length of the ulna and the length of the trunk. However there was no significant correlation between the length of the tibia or the length of the humerus and the trunk. There was no significant correlation between any of the long bones and the length of the trunk for any of the other subgroups.

There was significant correlation between the length of each long bone and stature. Overall, the femur was the highest correlate to stature ($r = .86$). The femur and the humerus both had the highest values of correla-

² See Appendix for all r values at all levels of significance

tion ($r = .81$) in Black females. In White females, the tibia was the best correlate to stature ($r = .89$). The humerus was the best correlate ($r = .85$) among females as a whole. The femur was the highest correlate in Black males ($r = .88$) and in White males ($r = .92$). For Blacks, the femur, tibia and humerus had equal values of correlation ($r = .85$). The femur was the highest correlate with stature ($r = .91$) for Whites. All sub-groups had significant correlation between the lumbar vertebrae and stature, except for Black males. There was correlation between the thoracic vertebrae in Blacks ($r = .50$) and Whites ($r = .63$), but not in the sub-groups divided by sex. However, White males had a significant correlation ($r = .51$). There was also significant correlation between trunk (thoracic + lumbar) and stature for all subgroups, except for Black males.

There was significant difference between the means of males and females in the humerus-stature ($t = 4.68$), ulna-stature ($t = 3.54$), and femur-humerus ratio ($t = 2.65$). Men have a higher ratio than women in both comparisons. There was significant difference between the means of Blacks and Whites in all of the ratios³, except for femur-stature, humerus-stature and tibia-humerus. Blacks have higher ratios than Whites in the all of the following comparisons: tibia-stature; ulna-stature; femur-trunk; tibia-trunk; humerus-trunk; ulna-trunk; femur-humerus. Whites have higher ratios than Blacks in all of the following comparisons: thoracic-stature; lumbar-stature; femur-tibia; humerus-ulna; femur-ulna. There was no significant difference between the means of femur-stature or tibia-humerus.

There was also no significant difference between the ratios of total limb length to stature or total

limb length to trunk size in either males and females or Blacks and Whites

Overall, the TG equation using the femur correlated had the highest correlation to actual stature ($r = .89$). The order from greatest to least following the femur is: fibula, radius, ulna and humerus. In Black females, the equation using the humerus was the highest correlate ($r = .82$), the one using the ulna was the least ($r = .71$). The equation using the fibula was the highest correlate to stature in White females ($r = .89$), and the one using the femur was the least ($r = .82$). The equation using the femur was the highest correlate in both Black males ($r = .88$) and White males ($r = .92$). The ulna was the least accurate in Black males ($r = .72$) and the humerus in White males ($r = .69$).

There was significant difference between true stature and predicted stature for the entire group when looked at as a whole, among females, and among Blacks. There was no significance between the difference of means in true stature and predicted stature for males or Whites.

For the group taken as a whole, TG underestimated stature for every long bone by an average of 1.99 cm. The equation for the femur had the highest bias with a measure of 3.59 cm. while the humerus had the lowest level of bias by 0.58 cm. TG underestimated stature for every sub-group, but by the least amount in White males (0.42 cm), and the most in Black females (3.42 cm.). On average, TG underestimated stature by 2.03 cm more in Blacks than in Whites. TG underestimated the stature of Black females by 3.42 cm. For Black females, the equation using the ulna gave the least amount of bias (2.73 cm.). The femur gave the highest amount of bias with a

measure of 4.83 cm. TG underestimated stature for White females by 1.89 cm. The equation using the femur was the highest degree of bias (2.96 cm.) and the humerus gave the least (0.46 cm.). TG underestimated stature in Black males by 2.95 cm. The equation using the femur had the highest level of bias (4.31 cm.), and the one using the humerus gave the least (1.02 cm.). TG also underestimated stature in White males by 0.42 cm. The equations using the humerus and the radius both overestimate stature, by an average of 1.34 cm. while the equation using the fibula had the greatest amount of bias (2.52 cm.) and the one using the radius had the least (-4 mm.).⁴

DISCUSSION

Most of the significant differences in limb and trunk between groups are based on racial affiliation rather than sexual dimorphism. Males have significantly longer arms (both proximal and distal) relative to stature than females. Females have shorter upper arms relative to thighs than males. There is no significant difference between Blacks and Whites in terms of femur relative to stature. Blacks have longer upper arms and shins relative to stature than Whites. Blacks also have longer thighs relative to upper arms than Whites. Whites have longer trunks relative to stature compared to Blacks in both the thoracic region and the lumbar region. Whites also have longer proximal limb segments relative to distal limb segments than Blacks.

These 'racial' differences were to be expected as they coincide with Bergmann's (1847) and Allen's (1877) rules. Bergmann's Rule states that within a single species, smaller-bodied organisms will be in the warmer

climates and larger-bodied organisms will be in the colder climates. Allen's rule is similar, but adds that organisms with longer extremities (limbs) will be found in warmer climates and organisms with shorter extremities will be found in colder climates. Taken together, people with a smaller surface area, or SA, (Allen's rule) to body mass, or BM, (Bergmann's rule) ratio will be in colder climates and people with a larger SA/BM ratio will be in warmer climates (Ruff, 1994). The evolutionary adaptation behind this phenomenon is to increase heat retention in colder climates and increased heat loss (Taylor-Weale and Vinicius, 2007). Paleoanthropological research has shown that humans have adapted to colder climates in Europe within the Upper Paleolithic. In the beginning, Europeans had longer limbs relative to stature than in modern-day European populations (Ruff, 2002). In the Hamann-Todd collection, my sample is consistent with this phenomenon; American Blacks retain the body proportions for a warmer climate and American Whites retain the body proportions for a colder climate. The Whites have longer trunks and shorter limbs relative to stature, and shorter arms relative to trunks than the Blacks. Blacks also have longer distal limb segments relative to trunk length. There is no significant difference in the ratios between total limb length (upper and lower) and stature, or trunk length, in either males and females, or among Blacks and Whites. The significant difference lies in the distal limb segments, which are longer in Blacks than Whites.

There is a significant correlation between all of the long bones and stature within each subgroup and within the entire sample as a whole. Overall, the femur is the best predictor of stature. This is to be expected since the T-test indicated that there was no significant

⁴ See Tables 6 through 8 for scatter plots involving HT vs TG stature.

difference in the femur-stature ratio between either Blacks and Whites, or males and females. Thus, the femur tends to have a stable relationship with stature across sex and population boundaries. In females, the best predictor of stature is the humerus. The humerus is not the worst predictor of stature in males, but it is worse in males than in females. The T-test indicated that there was not a significant difference in the ratio of humerus-stature on the basis of race, but there is a significant difference on the basis of sex. Women have shorter humeri than men, but the humerus has a more stable relationship to stature in females than in males. In Black females, both the femur and the humerus, taken independently, are the best predictors of stature. In White females, the tibia is the best predictor. In Black and White males, the femur is the best predictor. In Blacks, the femur, tibia, and humerus all equally predict stature the best. In Whites, the femur alone is the best. The lumbar region is significantly correlated to stature in each group, except for Black males, which suggests that Black males have higher variability in the length of the lumbar region. The thoracic region is significantly correlated in Blacks and Whites, the sample as a whole, and among White males. White males have the least amount of variability in the thoracic region, and there is a significant correlation with ancestral populations as opposed to sexual dimorphism.

When determining the best Trotter and Gleser (1952) equation to estimate stature, different statistical analyses yield different results. 'Best' can be defined as the highest r value in least squares regression, and the value closest to zero in the calculation of bias. The least squares regression analysis indicates that the equation using the humerus is the best estimate in Black females,

the fibula in White females, and the femur in both Black and White males. However, when deciding based upon the value for bias, the ulna is the best for Black females, the humerus is the best for White female and Black males, and the radius is the best for White males. The similarities between the correlation values and preferred equation indicate that for the specified bone, the sample that Trotter and Gleser measured represents the sample that I measured in the hierarchy of correlation. However, the T-test indicates that there is significant difference between the true stature and estimated stature in for all subgroups except Whites and males. The formulae provided by Trotter and Gleser underestimate stature for every bone in each subgroup, except for the humerus and radius in White males. For the average of every equation used, Trotter and Gleser underestimate stature in every sub-group; the least amount in White males and the most in Black females. Thus, it can be inferred that the original sample used by Trotter and Gleser is most similar to the Hamann-Todd sample I measured in White males, and least similar in Black females.

There are several limitations to the results of this study. First, the accuracy of stature measured by Todd may be invalid because the measurements were conducted on cadavers and not living individuals. Although Dupertuis and Hadden (1951) consider the measurement of cadavers to be equivalent to living stature, there is no way of knowing the stature in life of the persons in the Hamann-Todd collection to compare the two. Stature is a dynamic trait that varies throughout the day and throughout life. At the end of puberty, long bones have a constant relationship to each other. The length of the vertebral column decreases with age due to gravity putting force on the intervertebral disks as well as arthri-

tis decreasing the angle between adjacent vertebrae. The end result is that the back hunches and stature is shorter. Therefore, to qualify stature as one measurement may not validly describe overall stature. Although I tried to minimize this effect as best as possible, it is unknown whether or not it was completely controlled for in the study.

Second, there is questionable reliability and validity in the assessment of race. Racial classification was assigned based upon observations of colloquial traits on dead bodies; that is to say that different observers may disagree on the racial assignment of a particular individual. Even if every American were to agree upon the racial classification of a specimen, there still remains the fact that the ancestry is not known and any conclusions based on population variation would be skewed. Many American Blacks have mixed ancestry, even though they

consider themselves to be exclusively Black. The Whites included in this study come from a mixed European ancestry. The definition of White or Black depends upon the decision of Todd in the early 1900's. This is the problem with any study in regional variation, and its limitations have an effect on this study.

Thirdly, this study excludes 'abnormal' amounts of vertebrae. Many people have extra vertebra or may be missing a certain number. The present study considers only those who have twelve thoracic vertebrae and 5 lumbar. The results may be different if individuals with 'abnormal' amounts were included.

Lastly, the individuals in this study lived in the early 1900's and much secular change may have taken effect between then and now. Therefore, this study may not be applicable to a modern-day population or to a population outside of Cleveland, Ohio.

	Black Females			White Females			Black Males		
	Mean	SD	Variance	Mean	SD	Variance	Mean	SD	Variance
Age	38	8.4	70.56	38	8.5	72.25	37	9.4	88.36
Femur cm.	43.8	2.1	4.41	41.8	2.5	6.25	46.5	3	9
Tibia cm.	37.6	1.8	3.24	34.4	2	4	39.9	2.5	6.25
Fibula cm.	36.2	1.8	3.24	33.5	1.8	3.24	38.7	2.3	5.29
Humerus cm.	31.4	1.3	1.69	30.3	1.3	1.69	33.7	1.7	2.89
Ulna cm.	26.1	1.2	1.44	23.7	1.3	1.69	28.1	1.5	2.25
Radius cm.	24.3	1.1	1.21	21.9	1.3	1.69	26.2	1.5	2.25
Thoracic cm	22.9	1.6	2.56	23.6	1	1	24.8	1.3	1.69
Lumbar cm.	13.4	0.8	0.64	13.7	0.7	0.49	13.7	0.8	0.64
Trunk cm.	36.3	2	4	37.3	1.5	2.25	38.5	1.9	3.61
Stature cm.	164.5	7.2	51.84	160.8	6.2	38.44	172.7	7.7	59.29
	White Males			All			Females		
	Mean	SD	Variance	Mean	SD	Variance	Mean	SD	Variance
Age	39	10.1	102.01	38.2	8.5	72.25	38	8.4	70.56
Femur cm.	45.3	2.7	7.29	44.3	3.1	9.61	42.8	2.5	6.25
Tibia cm.	37.1	2.4	5.76	37.2	2.9	8.41	35.9	2.5	6.25
Fibula cm.	36.3	2.3	5.29	36.2	2.8	7.84	34.8	2.2	4.84
Humerus cm.	33.6	1.9	3.61	32.2	2.1	4.41	30.8	1.4	1.96
Ulna cm.	26.2	1.4	1.96	26	2.1	4.41	24.8	1.7	2.89
Radius cm.	24.5	1.3	1.69	24.2	2	4	23.1	1.7	2.89
Thoracic cm	25.4	1.5	2.25	24.2	1.6	2.56	23.3	1.4	1.96
Lumbar cm.	14.4	0.8	0.64	13.8	0.8	0.64	13.6	0.7	0.49
Trunk cm.	39.8	2.1	4.41	38	2.2	4.84	36.8	1.8	3.24
Stature cm.	171.2	6.8	46.24	167.3	8.5	72.25	162.6	6.9	47.61
	Males			Blacks			Whites		
	Mean	SD	Variance	Mean	SD	Variance	Mean	SD	Variance
Age	38	9.7	94.09	37	8.9	79.2	38	9.3	86.5
Femur cm.	45.9	2.9	8.41	45.2	2.9	8.4	43.5	3.1	9.6
Tibia cm.	38.5	2.8	7.84	38.7	2.5	6.3	35.7	2.5	6.3
Fibula cm.	37.5	2.6	6.76	37.5	2.4	5.8	34.8	2.5	6.3
Humerus cm.	33.6	1.8	3.24	32.5	1.9	3.6	31.9	2.3	5.3
Ulna cm.	27.2	1.7	2.89	27.1	1.7	2.9	24.9	1.8	3.2
Radius cm.	25.4	1.7	2.89	25.3	1.6	2.6	23.2	1.8	3.2
Thoracic cm	25.1	1.4	1.96	23.9	1.7	2.9	24.5	1.5	2.3
Lumbar cm.	14.1	0.8	0.64	13.6	0.8	0.6	14	0.8	0.6
Trunk cm.	39.1	2	4	37.5	2.2	4.8	38.5	2.2	4.8
Stature cm.	172	7.2	51.84	168.6	8.5	72.3	38	8.3	68.9

Table 1. Demographic information and bone measurements (cm).

	Bias	SD Bias	Inaccuracy	SD Inaccuracy
Long bones	0.04	0.05	0.06	0.67
Femur	0.05	0.05	0.05	0.05
Tibia	0.6	0.31	0.16	0.27
Fibula	0.03	0.05	0.03	0.05
Humerus	0.03	0.05	0.03	0.05
Ulna	0.04	0.05	0.04	0.05
Radius	0.05	0.05	0.05	0.05
Vertebral height	0.005	0.10	0.02	0.09
Trunk	0.08	0.11	0.1	0.09

Table 2. Intraobserver error (cm).

Femur/Stature		Tibia/Stature		Femur/Trunk		Tibia/Trunk	
All	Blacks	All	Blacks	All	Blacks	All	Blacks
Avg 0.26 SD 0.01 N 122 Females	Avg 0.27 SD 0.01 N 60 Whites	Avg 0.22 SD 0.01 N 122 Females	Avg 0.23 SD 0.01 N 60 Whites	Avg 1.17 SD 0.08 N 126 Females	Avg 1.21 SD 0.08 N 62 Whites	Avg 0.98 SD 0.08 N 126 Females	Avg 1.04 SD 0.07 N 62 Whites
Avg 0.26 SD 0.01 N 61 Males	Avg 0.26 SD 0.02 N 62	Avg 0.22 SD 0.01 N 61 Males	Avg 0.22 SD 0.01 N 62	Avg 1.16 SD 0.08 N 63 Males	Avg 1.13 SD 0.07 N 64	Avg 0.98 SD 0.08 N 63 Males	Avg 0.93 SD 0.06 N 64
Avg 0.27 SD 0.01 N 61		Avg 0.22 SD 0.01 N 61		Avg 1.18 SD 0.09 N 63		Avg 0.99 SD 0.08 N 63	
Humerus/Stature		Ulna/Stature		Humerus/Trunk		Ulna/Trunk	
All	Blacks	All	Blacks	All	Blacks	All	Blacks
Avg 0.19 SD 0.01 N 122 Females	Avg 0.19 SD 0.01 N 60 Whites	Avg 0.16 SD 0.01 N 122 Females	Avg 0.16 SD 0.01 N 60 Whites	Avg 0.85 SD 0.05 N 126 Females	Avg 0.87 SD 0.05 N 62 Whites	Avg 0.69 SD 0.06 N 126 Females	Avg 0.73 SD 0.05 N 62 Whites
Avg 0.19 SD 0.00 N 61 Males	Avg 0.19 SD 0.01 N 62	Avg 0.15 SD 0.01 N 61 Males	Avg 0.15 SD 0.01 N 62	Avg 0.84 SD 0.05 N 63 Males	Avg 0.83 SD 0.05 N 64	Avg 0.68 SD 0.06 N 63 Males	Avg 0.65 SD 0.04 N 64
Avg 0.19 SD 0.01 N 61		Avg 0.16 SD 0.01 N 61		Avg 0.86 SD 0.06 N 63		Avg 0.70 SD 0.06 N 63	
Thoracic/Stature		Lumbar/Stature		Femur/Tibia		Femur/Humerus	
All	Blacks	All	Blacks	All	Blacks	All	Blacks
Avg 0.14 SD 0.01 N 122 Females	Avg 0.14 SD 0.01 N 60 Whites	Avg 0.08 SD 0.00 N 122 Females	Avg 0.08 SD 0.00 N 60 Whites	Avg 1.19 SD 0.04 N 126 Females	Avg 1.17 SD 0.03 N 62 Whites	Avg 1.38 SD 0.05 N 126 Females	Avg 1.39 SD 0.04 N 62 Whites
Avg 0.14 SD 0.01 N 61 Males	Avg 0.15 SD 0.01 N 62	Avg 0.08 SD 0.00 N 61 Males	Avg 0.08 SD 0.00 N 62	Avg 1.19 SD 0.04 N 63 Males	Avg 1.22 SD 0.03 N 64	Avg 1.39 SD 0.04 N 63 Males	Avg 1.37 SD 0.05 N 64
Avg 0.15 SD 0.01 N 61		Avg 0.08 SD 0.00 N 61		Avg 1.20 SD 0.04 N 63		Avg 1.37 SD 0.05 N 63	
Trunk/Stature		Femur/Ulna		Tibia/Humerus		Humerus/Ulna	
All	Blacks	All	Blacks	All	Blacks	All	Blacks
Avg 0.23 SD 0.01 N 122 Females	Avg 0.22 SD 0.01 N 60 Whites	Avg 1.71 SD 0.09 N 126 Females	Avg 1.67 SD 0.07 N 62 Whites	Avg 1.16 SD 0.05 N 126 Females	Avg 1.19 SD 0.03 N 62 Whites	Avg 1.24 SD 0.06 N 126 Females	Avg 1.20 SD 0.04 N 62 Whites
Avg 0.23 SD 0.01 N 61 Males	Avg 0.23 SD 0.01 N 62	Avg 1.73 SD 0.08 N 63 Males	Avg 1.75 SD 0.08 N 64	Avg 1.17 SD 0.05 N 63 Males	Avg 1.12 SD 1.12 N 64	Avg 1.24 SD 0.06 N 63 Males	Avg 1.28 SD 0.05 N 64
Avg 0.23 SD 0.01 N 61		Avg 1.69 SD 0.08 N 63		Avg 1.14 SD 0.06 N 63		Avg 1.24 SD 0.06 N 63	

Table 3. Ratios for bones-stature and bone-bone.

(Femur+Tibia)/Stature		(Humerus+Ulna)/Stature	
All	Blacks	All	Blacks
Avg 0.49	Avg 0.50	Avg 0.35	Avg 0.35
SD 0.02	SD 0.01	SD 0.01	SD 0.01
N 122	N 60	N 122	N 60
Females	Whites	Females	Whites
Avg 0.48	Avg 0.48	Avg 0.33	Avg 0.37
SD 0.02	SD 0.01	SD 0.33	SD 0.01
N 61	N 62	N 61	N 62
Males		Males	
Avg 0.49		Avg 0.36	
SD 0.02		SD 0.36	
N 61		N 61	
(Femur+Tibia)/Trunk		(Humerus+Ulna)/Trunk	
All	Blacks	All	Blacks
Avg 2.15	Avg 2.24	Avg 1.53	Avg 1.60
SD 0.16	SD 0.15	SD 0.11	SD 0.09
N 122	N 60	N 122	N 60
Females	Whites	Females	Whites
Avg 2.14	Avg 2.06	Avg 1.51	Avg 1.48
SD 0.16	SD 0.12	SD 0.10	SD 0.08
N 61	N 62	N 61	N 62
Males		Males	
Avg 2.16		Avg 1.56	
SD 0.17		SD 0.11	
N 61		N 61	

Table 4. Ratios for total limb length to stature and trunk.

	Males vs Females	Blacks vs Whites
Femur/Stature	1.51	1.86
Tibia/Stature	0.04	10.24
Humerus/Stature	4.68	0.12
Ulna/Stature	3.54	9.66
Thoracic/Stature	1.80	4.40
Lumbar/Stature	2.14	5.30
Trunk/Stature	0.41	6.17
Femur/Trunk	0.80	5.66
Tibia/Trunk	0.53	9.71
Humerus/Trunk	2.41	4.75
Ulna/Trunk	2.07	10.48
Femur/Tibia	0.44	9.30
Femur/Humerus	2.65	2.68
Tibia/Humerus	2.29	0.50
Humerus/Ulna	0.54	10.65
Femur/Ulna	2.37	6.27
(Femur+Tibia)/Stature	1.21	1.42
(Humerus+Ulna)/Stature	0.06	1.89
(Femur+Tibia)/Trunk	0.12	0.15
(Humerus+Ulna)/Trunk	0.19	0.23

Table 5. T-scores for ratios in sexual dimorphism and racial variation.

HT Stature			TG Stature		
All		Blacks	All		Blacks
Avg	167.3	Avg	168.6	Avg	165.2
SD	8.5	SD	8.5	SD	7.2
N	122	N	60	N	122
Females		Whites		Females	
Avg	162.6	Avg	166.0	Avg	159.8
SD	6.9	SD	8.3	SD	4.7
N	61	N	62	N	61
Males				Males	
Avg	172.0			Avg	170.6
SD	7.2			SD	5.1
N	61			N	61

Table 6. Measurements for HT stature and TG stature (cm).

	HT vs TG Stature				
	All	Females	Males	Blacks	Whites
<i>t</i> score	2.71	3.11	1.51	2.75	1.10
<i>df</i>	121	60	60	59	61

Table 7. T-scores in HT vs TG stature for sub-groups.

	Bias					SD Bias				
	BF	WF	BM	WM	All	BF	WF	BM	WM	All
HT vs TG Femur	4.83	2.96	4.31	1.85	3.59	4.35	3.67	3.43	2.7	3.8
HT vs TG Fibula	3.25	2.84	2.6	2.52	2.82	4.8	2.93	4.74	3.74	4.03
HT vs TG Humerus	3.17	0.46	1.02	-2.28	0.58	4.5	3.2	5.39	4.79	4.82
HT vs TG Ulna	2.73	1.58	1.23	0.41	1.56	5.17	3.69	5.85	4.18	4.74
HT vs TG Radius	3.11	1.59	1.06	-0.4	1.4	5.15	3.33	5.62	3.94	4.63
	Inaccuracy					SD Inaccuracy				
	BF	WF	BM	WM	All	BF	WF	BM	WM	All
HT vs TG Femur	4.99	3.71	4.45	2.39	4.03	4.16	2.89	3.19	2.22	3.33
HT vs TG Fibula	4.18	3.52	4.03	3.25	3.8	3.98	2.02	3.24	3.1	3.12
HT vs TG Humerus	4.12	2.7	4	4.1	3.76	3.63	1.71	3.19	3.32	3.04
HT vs TG Ulna	4.15	3.15	4.25	3.12	3.74	4.08	2.44	3.66	2.75	3.28
HT vs TG Radius	4.47	2.93	4.13	2.95	3.68	3.99	2.2	3.39	2.58	3.13

Table 8. Bias and Inaccuracy of TG Stature estimation.

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Nada es Sencillo: un Análisis de Cinco Películas Almodovareñas



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To me, there exists no comparison between watching a Hollywood “blockbuster” and a Spanish film. Little creativity, passion, or stepping outside of the lines is shown with most stateside productions, unfortunately. After taking a course on Latin-American cinema in the fall of 2005, I approach films quite differently. I analyze the angle in which the camera is shooting the scene, the chronology of the story, and outlooks subtly directed toward the viewer. Latin American and Spanish films led me to examine all things I see in a special fashion. Many of the movies I had watched in the class were controversial in scope and did not win the approval of the government at the time of their conception, thus being limited in their public presentation ability. As time passed and democracy achieved, more and more people were able to view once-banned masterpieces and wonder how citizens prevailed despite times of political unrest. One of the Spanish-speaking countries that flourished in cinema after war and dictatorship was Spain. Some of my favorite films were made there by cineaste Pedro Almodóvar, evoking both beauty and awareness through the stories told through the camera lens. *Matador*, *Mujeres al borde de un ataque de nervios*, *¡Átame!*, *Carne trémula*, y *Hable con ella* provide the viewer with what is missing in U.S. cinema. The exploration of five contemporary Spanish films allows me to extrapolate the meanings of their themes and topics so that I can reveal the masterpiece-like quality within Almodovarian films that keeps art house movie audiences astounded.

A pesar de la variación en material sujeto, las películas largometrajes del Pedro Almodóvar contienen elementos que contribuyen similares al fórmula del éxito que lo ha sostenido Almodóvar como al cineasta estreno, el creador del altamente aclamado reciente trabajos *La Mala Educación* y *Volver*, confían pesadamente en desarrollar producciones multigéneras, junto con el exhibir el negocio inacabado de un carácter, para resultar un producto brillante. Por ejemplo, *Carne trémula* demuestra a vencedor del protagonista, que acaba de ser lanzado de una restricción de cinco años en cárcel, en el sepulcro de su madre. Mientras que allí, él encuentra el objeto de la lujuria que se llama Elena, que era responsable del encarcelamiento. La relevación se convierte en repentinamente venganza para el vencedor, y la película demuestra el factor del choque que continuará a través de la historia. Torceduras y vueltas al progreso del guion la experiencia de complacerse en la utopía Almodovareña. Un paseo alocado cinematográfica sobreviene para el espectador, consecuentemente. Continuamente empleando los elementos encontraron dentro de su modelo cinematográfica y ejercitando el evolución con cada proyecto terminado, Pedro Almodóvar se distingue como digno del almacenar la alabanza mundial para sus obras maestras cinematográficas.

La carrera de Pedro Almodóvar ha atravesado tres décadas, con dieciséis películas llenas de la longitud producidas hasta la fecha: *Volver* (2006), *La mala educación* (2004), *Hable con ella* (2002), *Todo sobre mi madre* (1999), *Carne trémula* (1997), *La flor de mi secreto* (1995) *Kika* (1993), *Tacones lejanos* (1991), *¡Átame!* (1990), *Mujeres al borde de un ataque de nervios* (1988), *La ley del deseo* (1987), *Matador* (1986), *¿Qué he hecho yo para merecer esto?* (1984),

Entre tinieblas (1983), *Laberinto de pasiones* (1982), y *Pepi, Luci, Bom y otras chicas del montón* (1980). Cada película exhibe asuntos que ponen en contraste y contiene simultáneamente las características similares que no sólo identificarlas como estando de Almodóvar, sino también agregar a su éxito colectivo. Éstos incluyen el uso de caracteres femeninos, la fluidez de los papeles del género, caracteres con obsesiones, y conclusiones del renacimiento de la muerte. Este papel demostrará cómo cinco de películas del Almodóvar alcanzan éxito por incorporar un formato que abarque todos los dispositivos cinematográficas ya mencionados. La innovación sobreviene, pues el estilo y la técnica se refinan sobre los años en cinematografía. La ejecución y el contenido de películas diferencian a partir de la una otra, dependiendo de la década en la cual fueron hechos. *Matador* (1986), *Mujeres al borde de un ataque de nervios* (1988), *¡Átame!* (1990), *Carne trémula* (1997), y *Hable con ella* (2002) serán analizadas, como proporcionan evidencia a la progresión gradual del Almodóvar como cineasta creativo.

Para entender la discusión del papel de cinco películas, una breve introducción de la historia proporciona la penetración en sus guiones respectivos. En el documental del Almodóvar, el narrador Jonathan Ross describe *Matador* "como asunto del amor entre un torero jubilado, Diego Montes, y un abogado femenino hermoso, María Cardenal, que encuentra el cumplimiento sexual entre matar a sus socios en el momento del orgasmo." Algunos años más adelante, *Mujeres al borde de un ataque de nervios* contó la historia de las mujeres que fueron estados hartos de cansado con los hombres. La actriz Pepa Marcos demuestra sus lazos emocionales al actor perpetuo

Iván, que la ha dejado recientemente para otra mujer. El comienzo de los años noventa trajo *¡Átame!* a los teatros, trayendo la controversia para su historia del amor entre una estrella anterior del pornografía y un paciente anteriormente psicótico. *Carne trémula* es una novela de suspense erótico, basado libremente apagado de la novela por Ruth Rendell. La protagonista Víctor Plaza se encarcela para un crimen que él no confió y los destinos chocan cuando él ve repentinamente su agolpamiento anterior con el poli que lo acusa falso de asalto. La película hecha más reciente de ésas elegidas, *Hable con ella*, acentúa la conversación como remedio a esos comatosos, como la experiencia disímil de dos hombres hospitalizó a mujeres. Así, la variedad existe para los temas de la película, con todo Pedro todavía no se ha perdido de ciertas calidades cinemáticas, como incluir a una abundancia de mujeres en todos sus proyectos.

Las hembras dominan en el mundo de Pedro. Es importante vislumbrar en su biografía para entender la presencia de mujeres fuertes como caracteres principales. Nació en la región de Castilla La Mancha en 1949, él observó que su madre mantuvo a familia unida, en comparación con su padre, que llevó a cabo una ciénaga del punto bajo que pagaba trabajos y no era casero a menudo. En una entrevista con el cineasta Jonathan Ross, el jefe de *El Deseo*, Agustín Almodóvar explicó que "[los caracteres femeninos] fueron inspirados por mi fuerza de la madre, la inteligencia, y las mujeres positivas de la actitud demuestran [...] no importa qué las dificultades ellas hacen frente, no se presionan ni dan para arriba en la cara de la adversidad." Francisca Caballero, la madre de Pedro y Agustín Almodóvar, ha desempeñado posteriormente papeles del

camafeo en algunas películas lo más notablemente posible en *Kika*, una comedia oscura, como anfitrión de un programa de la televisión de la revisión de libro. No todos los países promueven la inclusión de mujeres mientras que los agentes del plomo en películas y Pedro observan esto diciendo que "en la década pasada, usted puede contar el número de los dramas de Hollywood que han girado alrededor de mujeres. Los estudios tienen olvidado que las mujeres son fascinadoras." Si una persona examinara el número de las películas lanzadas en los Estados Unidos que destacaron a actrices en papeles importantes, la cantidad sería horriblemente bajar que esperada. Las hembras tienden para tener papeles de soporte en el molde en comparación con conducen unos, restante un carácter espectador. Por el contrario, Almodóvar ha ofrecido a mujeres de maneras prominentes en sus trabajos y anima siempre a otros que sigan el juego.

Matador presenta dos caracteres femeninos de personalidades que varían: uno es abogado de defensa criminal distinguido, María Cardenal, y el otro desempeña el papel de la novia de Diego, Eva. Según Paul Julian Smith, las mujeres están de dos diversas especies (71). María, como el objeto de su afecto Diego, recibe placer sexual sobre la matanza sus socios sexuales cuando alcanzan orgasmo. Ella consigue lo que ella desea y viste a parte de una persona ambiciosa, en el traje masculino (Smith 71). Una escena significativa implica a María después de Diego en el baño de los hombres al teatro de la película; ella también necesitó quitar una mancha roja del lápiz labial de sus pantalones.

“Este es el lavabo de hombres, ¿no has visto el letrero?”

–Diego a María.

“No te fíes de las apariencias.”

–María a Diego.

Eva, un modelo popular, acentúa su feminidad por un acercamiento generalizado. Una escena notable en la película ocurre mientras que Diego y Eva están haciendo el amor; Eva juega muerta para que Diego culmine. Aunque ella alcanza un nivel similar del éxtasis, el comportamiento sumiso Eva retratado disminuye su virilidad a un grado. Eva no puede excitarse por el uso de necrofilia, desemejante de su novio y María, con todo es una mujer moderna en que ella es carrera orientada y no completamente dependiente en Diego. Las características angulares del abogado ponen en contraste agudamente con las características angelicales de Eva, así como sus deseos sexuales (Smith 69).

“Nadie me ha besado siempre como eso. Hasta este momento, siempre hice el amor solo. Le deseo más que deseo morirme. ¿Ud. tiene gusto de verme muerta? - María a Diego. Sí, y ése Ud. ve morirme.” - Diego a María.”

El extremo de la película da lugar a la matanza mutua de María y Diego durante su primer y último encuentro sexual. Eva, debe ser asumido, la continuará que modela trabajos y encontrará a alguien más compatible a ella. Ambas mujeres revelan diversas maneras de estar del género femenino e incorporan las calidades asociadas al modelo femenino del papel de Almodóvar.

Mujeres al borde de un ataque de nervios entrega otro carácter femenino realizado que experimenta la traición masculina. Pepa Marcos, actriz famosa, vive cómodamente en un vecindario agradable de Madrid. La uniera una vez a un agente del compañero que se llama Iván, que la traicionó recientemente para otra mujer. No asombrosamente, la desintegración ha producido un efecto devastador para la actriz y el sueño requiere un tranquilizante. Las escenas que demuestran Pepa desesperado incluyen el que está al principio de la película, mientras que Iván la llama del estudio de la película en donde los dos trabajan, para notificarla que ella había dormido demasiado. Pepa falta la llamada y sobre llegar el estudio, encuentra una nota él poner en el escritorio principal, con dos números de teléfono, en su cursivo. Serena, ella llama los números misteriosos, alcanzando a un amante anterior de Iván que crea Pepa sabe el suyo paradero. El hombre ha visto en una manera negativa, pues el espectador ahora realiza que él es un jugador de la especie femenina.

“Aprender a mecánicos es más fácil que la psicología masculina que aprende. Usted puede calcular fuera de una bicicleta, pero usted puede nunca calcular fuera de un hombre.” - Pepa un Ana.

Ana, un amigo de la actriz que tiene miedo de los informes de las noticias que los terroristas chiitas secuestraban un aeroplano de Madrid, tiene problemas mismos. Ella tenía recientemente un arrojarse con un hombre chiita que llegó recientemente su apartamento, preguntando si él y los amigos podrían vivir por algunos días. El temer del tiempo de la cárcel para su implicación con los hombres, ella llega el apartamento de Pepa a mitad de la distancia a través de la película y busca consejo de su amigo. Después de discutir su

problema, Ana procura saltar apagado del balcón de Pepa. En respuesta a esta acción, Pepa declara a "gente joven no sabe luchar; lo único que desea es placer y él no sabe sufrir." No hay duda que Pepa está devastado que su amante ha huido, pero su independencia y fuerza llevan a ella. En el extremo de la película, uno de los amantes locos de Iván descubre que él está en el camino al Estocolmo y que traza matarle. Pepa la sigue al aeropuerto y ahorra a su amante desconsiderado temporalmente deteriorando a la mujer loca. En vez de mirarlo el tiro, la actriz siempre encantadora ahorra su muerte y sale precipitadamente del aeropuerto. La escena final revela el embarazo de Pepa, asumiendo que el padre es Iván. El protagonista termina la película con una dominación adquirida sobre su uno mismo emocional mientras que todavía parece hermoso (Girelli 256). El amor es un aspecto importante de la vida y de un cambio traumático cuando se separa una relación. Almodóvar desea transportar un mensaje que las mujeres puedan y recuperen de un revés, mientras que todavía abraza sus calidades femeninas. Pepa fue introducida de hecho como una víctima; en un cierto plazo, ella ha agarrado su fuerza interna y ha perseverado para ser independiente. Las películas sucesivas, por ejemplo *Carne trémula* y *Hable con ella*, ofrecen caracteres femeninos contemporáneos, pero también incluyen los papeles masculinos que demuestran el género diferente positivamente.

El machismo no se tolera en el mundo Almodovareño. Caracteres que se comportan en una manera chauvinista no alcanzan un resultado positivo en el guion: los ejemplos notables consisten en el marido antipático de Gloria que fue matado por ella en *¿Qué he hecho para merecer esto?* y Manuel, al marido egotista

de Rebeca y al novio anterior de la madre de Rebeca, Becky, fue matado por su esposa en *Tacones Lejanos*. Para casi la primera década de su carrera, Almodóvar tendido para no utilizar muchos caracteres rectos de los hombres y por lo tanto fue etiquetado como "director de las mujeres." (Smith 2) Los críticos sugirieron que la prueba verdadera de su talento implicara el crear los caracteres masculinos convincentes, después considerando *Todo sobre mi madre*, una película con una afluencia de las personas transexuales y de las lesbianas (prefacio de Smith). Para qué los opositores se olvidaron eran la condolencia y la empatía con las figuras masculinas fuertes, complejas, y preocupadas desarrolladas en *Carne trémula*, lanzado dos años antes de *Todo sobre mi madre* (prefacio de Smith).

"Si no bebo, mataré a [Clara]."

-Sancho a David de Paz.

Carne trémula tenía tres caracteres principales: Víctor Plaza, el hombre incorrecto condenado que pasó cinco años en la cárcel; David de Paz, policía anterior dañado del empate involucrado a Víctor, Elena, and Sancho; y Elena, un drogadicto anterior y esposa actual de David. El libro, titulado Live Flesh, en la cual *Carne trémula* fue basada, estableció Víctor como violador en serie, un ladrón, y un asesinato, además de tirar a David (Willem 116). Él se excusa continuamente de sus crímenes poniendo la culpa en otras, demandando que él es incapaz de refrenarse porque su cuerpo produce respuestas espontáneas a las situaciones en las cuales lo colocan (Willem 116). En contraste, la adaptación de Almodóvar de la novela a la película crea a Víctor como víctima inocente, simplemente estando en el lugar

incorrecto en el tiempo incorrecto (Willem 117). Algunas semanas después de que Víctor se lance de la prisión, David descubre de Elena que Víctor se ha estado ofreciendo voluntariamente en el abrigo de sus niños, El Fontanar. Una confrontación sobreviene un día entre David y Víctor, después de que David llegue inesperado al refugio para hablar con su enemigo Víctor, demuestre con éxito la lucha entre el Sancho y sí mismo, puesto que él y David se están atacando en la alfombra en oficina de Elena. Esto prueba que Víctor no era responsable de tirar del disparador; Sancho, el policía alcohólico, tiro a David. Víctor entonces proclama que Sancho confió el crimen que resultó en daño para David, quien persiguiendo una relación con la esposa de Sancho, Clara. En ese momento, el espectador entiende que David debe aceptar la culpabilidad en vez de Víctor, que lo habían culpado perpetuo por su inhabilidad (Willem 116). Mientras que el carácter nuevamente absuelto se ha limpiado de culpa, él ha realizado algunos malos hechos en la película, tal como tener un asunto con Clara. Sin embargo, la conclusión demuestra Víctor en la misma plaza en la cual él nació, con su esposa embarazada, Elena. David y Elena han divorciados y él está viviendo en Miami, mientras que Sancho y su esposa se mataron en la casa del Víctor. En una entrevista con Paul Julian Smith, Almodóvar afirma que Elena se casó con David como acto del auto castigo que le ayuda a compensar culpabilidad sobre suya papel en el parálisis de David." (186). Hace no más de largo culpabilidad existen en los caracteres inocentes, pues reside en Sancho y David. Los caracteres masculinos en la película variaron en términos de sus comportamientos y su sino resultó de si o no eran inocentes o culpables, con todo entrelazada con firmemente en la narrativa de

la historia en *Carne trémula*. La misma declaración se aplica al Benigno Martín y Marco Zuloaga, los protagonistas en *Hable con ella*.

Las calidades afeminadas saturan las personalidades de los caracteres prominentes en *Hable con ella*, una de las películas aplaudidas de Almodóvar. Por otra parte, las calidades masculinas fueron encontradas dentro de algunos de los caracteres femeninos. Esta fluidez compleja en la diferenciación del género agrega al romance, a la tristeza, a la tauromaquia, y a las narrativas de la enfermedad. Los protagonistas Benigno Martín y Marco Zuloaga son los primeros caracteres vistos en la película, atendiendo a una producción de Pina Bausch que se llama *Café Müller*. Repentinamente, la cámara fotográfica enfoca adentro en la cara no obstante cincelada de Marco, y es evidente que lo abruman con la emoción del funcionamiento. La acción de dos mujeres ocultas que luchan para viajar a través de una etapa llenada de las sillas yuxtaponiendo con un hombre que procura dirigirlas. Benigno, que mira joven, sentaba al lado de Marco pero los dos no todavía conocidos, y anota su episodio de tristeza. El bailar a través de un mundo de obstáculos es el tema del acto de *Café Müller*, que volverá recurrentemente a través de la película. Benigno, vestido en un uniforme del hospital, utiliza un archivo del clavo en una mano blanda y charla con una persona inidentificable con respecto al espectáculo de Marco que lloraba durante la producción la noche anterior. A este punto, el resto del miembros de las audiencia deslumbrado en cuanto a con quién él está hablando. Ve al cuerpo comatoso de una mujer joven atractiva después, que mano está siendo llevada a cabo por Benigno, probablemente ayudante de una enfermera

o enfermero. En las escenas siguientes, el nombre de la mujer se descubre para ser Alicia. Benigno y otra enfermera comienzan a limpiar al paciente dando un baño de la esponja y cambiando su ropa luego. La posición de una enfermera es llevada a cabo normalmente por una hembra y la manera en quienes los cuidados de Benigno para el mantenimiento de Alicia sean impecables, algo un pedacito impar al espectador que ve simplemente a mujer inconsciente el poner completamente en una cama del hospital. Dos de las características afeminadas de Benigno se ven algo rápidamente en la historia. Sin embargo, de esta presentación inicial del carácter, las audiencias también reconocen éticas fuertes del trabajo de Benigno- que una enfermera nombrada Matilde incorpora algunos momentos después de la limpieza de Alicia, preguntando si él podría tomar su cambio. Él no vacila trabajar hacer horas extras, identificándose con la situación del marido de Matilde que ha huido a la familia recientemente. Concurrentemente, Marco ejercita en su apartamento y mira una demostración de la charla que torero femenino Lydia Torres de las características. Él se encanta después de atestiguar su salida precipitada del programa, ofendido por las preguntas tuvo como objetivo su relación recientemente quebrada con el torero El Niño de Valencia del compañero. Excitado para solicitar un artículo de la página llena en el periódico de domingo, Marco visita a Lydia en una barra donde ella frecuenta después de la corrida de toros. Él le acerca para discutir la petición y ella pide repentinamente que él un paseo, evite de tener que hablar con el par que se acerca integrado por El Niño de Valencia y su encargado. Marco aparece ser suave y confiable al pedir Lydia para hacer una

entrevista en el camino a su casa. En la destinación, la mujer normalmente resistente emite un grito aterrador que una serpiente fue encontrada en su cocina. Marco se pide para matar al animal, y después de realizar la tarea tradicionalmente masculina, él vierte algunos rasgones en su manera nuevamente dentro de su coche. En la película hasta el momento, dos casos han ocurrido donde ha llorado Marco. Algunos meses pasarán antes de la reunión de Benigno y Marco en un ajuste desafortunado, unido por un problema similar. Lydia, el torero, baja en un estado comatoso, después del toro la corneó. Incidentemente, ella es un paciente en El Bosque, el mismo hospital donde Alicia pone sin vida. Marco permanece en su cabecera, loca con la condición de la mujer que él amó. Qué él no sabe como él espera sin objetivo es que Lydia no estaba en amor con él y en lugar de otro había elegido volver a los brazos de El Niño de Valencia, su novio anterior. Marco, amante de mujeres complicadas, perseguidas una relación seria con Ángela antes de que le conociera a Lydia. Él era loco sobre la desintegración con Ángela, que lo acompañó en los viajes para su ocupación como un escritor de viaje. Era en su boda en el campo que él realizó su aceptación total que la relación encima, pues Lydia sollozaba en una manera incontrolable durante la ceremonia mientras que él escuchó con una presencia sin emociones. Esta escena, que ocurrió antes del accidente de Lydia, interpreta a Marco masculino y Lydia emocional, más afeminada que la mayoría de su representación en la película. Ella demuestra raramente una feminidad después de eso. Una distinción aguda se observa en el hospital entre Marco y Lydia. El Niño de Valencia se sienta en el sitio de Lydia y Marco entra en el cuarto. Él descubre que Lydia lo tendría

dicho que ella se enamorara de El Niño la noche después de la corrida de toros trágica. Devastado, Marco deja El Bosque y nunca vuelve a la clínica durante la estancia de Lydia. Lydia se parece poseer el aura masculina en esta etapa, mientras que Marco se afecta enormemente y se siente derrotado. Un punto interesante a considerar gira alrededor de la calidad de los cuerpos de Alicia y de Lydia mientras que está hospitalizado. Lydia recibe raramente el tratamiento de las enfermeras como eso demostrado en Alicia. Benigno, visitando a Marco y Lydia en un día, realiza que su piel es seca y pide Marco si él ha cuidado de Lydia. Marco, encontrando el comentario absurdo, dice no de Benigno. La cámara fotográfica se centra en el cuerpo de Alicia, que se lo parece a una persona viva en términos de su condición. El cuerpo de Lydia se considera en marcos parciales y su salud aparece débil. Ella siguió exhibiciones de la muerte una inhabilidad de sobrevivir fuera consolidada. El consejo de Benigno a Marco fue sin usado y pudo haber causado un milagro para Lydia. Quizás el alma de Lydia no podía vivir en un estado débil perpetuo, aunque ella recupere consciencia. Pedro no trató simplemente Lydia como carácter femenino y transfirió la feminidad a Marco, que combinó los géneros por sus acciones. Las líneas veladas del género caracterizan papeles en películas recientes. Otra manera los caracteres se distinguen tener que ver con sus obsesiones y negocio inacabado posterior.

¡*Átame!* enfoca del conflicto de su carácter central que forma el corazón del argumento. Las películas restantes *Matador*, *Mujeres al borde de un ataque de nervios*, *Carne trémula*, y *Hable con ella* también incorporan batallas empollando en varios de los caracteres. El énfasis en los dilemas de los protagonistas

facilita una explicación en las películas previamente mencionadas. Comenzando al principio, la audiencia aprende sobre quién el carácter se obsesiona. Un rasgo único del cine Almodovareño evita que los juicios se presenten dentro del guion; el cineasta confía a los espectadores para estructurar opiniones sobre los caracteres de su propia creencia. No asombrosamente, diversos grupos de gente sacan respuestas que varían a la misma película. En el comentario audio de DVD para *Hable con ella*, Pedro Almodóvar y Geraldine Chaplin, que hace el papel de Katerina, profesor de la danza de Alicia, destacan una escena que produjo risa de las audiencias. La respuesta de Lydia a una serpiente encontró en la cocina en su hogar sacado ríe nerviosamente de espectadores americanos, debido a su búsqueda de una ocupación peligrosa. ¿Cómo es posible ser asustado por un reptil? Los espectadores españoles de la película rieron menos, entendiendo la fobia. Chaplin comentó que "una fobia es una cosa seria, pero el fondo cultural se determina qué se considera divertido o triste." Los resultados opuestos sucedieron con un panorama en la película ¡*Átame!*, de quién premisa es descrita abajo por Almodóvar: ¡*Átame!* está esencialmente una historia del amor, o algo una historia de cómo alguien procura construir una historia del amor de la misma manera que él puede ser que estudie para un grado; por medio de esfuerzo, accionará, y persistencia. ¿Se bosqueje la pasión con antelación, calculada y entonces poniendo en otras personas? Cuando usted no tiene nada, como mi carácter principal, le tienen que forzar todo. Incluyendo amor. Ricki, el papel hecho por Antonio Banderas, es un muchacho que ha pasado su vida en instituciones públicas. Dejado huérfano en la edad tres, su vida entera ha sido una interminable emigra

a través de orfanatos y de hogares mentales. Cuando dejan hacia fuera en la calle, Ricki tiene solamente (mientras que los cantantes del flamenco dicen) la noche, el día, y la vitalidad de un animal. (El País según lo citado en Smith 107).

Los críticos españoles se parecían raramente preguntar de Almodóvar de la idealización de su película más atrevida todavía, proclamación de ella una historia del amor de la oferta del 'la opinión terrible' y convenir con el director que la mejor escena era la en las cuales el marina de la actriz del drogadicto y del porno, rehén inicialmente sostenido de Ricki contra ella voluntad, finalmente pide ser atado para arriba por él; esto es así que la no tentarán para huir del amor que él ha provocado con éxito en ella (Mojica según lo citado en Smith 108). Un crítico llama este deseo para el 'del esclavitud la intensidad más grande del amor', una declaración 'feminista' (Maqua según lo citado en Smith 108). Los ciudadanos españoles se sentían semejantemente, pues pagaron el dinero para ver la película y recitaron palabras de alabanzas después de la ocasión. Como *Mujeres al borde de un ataque de nervios*, ¡*Átame!* era la película doméstica el grande-ganar en total de su año, alcanzando a una audiencia de sobre millón antes de agosto de de 1990 (Smith 108). Horriblemente, su presupuesto era más bajo que dos otras películas españolas, ¡*Ay Carmela!* y *El sueño del mono loco*, que fueron producidas en el mismo año (Alberich según lo citado en Smith 108). Las audiencias americanas no compartieron las opiniones que brillaban intensamente de españoles y no condenaron el comportamiento muy misógino realizado por Ricki encima de Marina. Después de que su lanzamiento de un hospital psiquiátrico, Ricki intente encontrar a su amante

que dura una noche anterior, Marina. Él ha sido enamorado de la estrella del porno desde entonces él la satisficiera en una barra durante un breve escapa del hospital. Su encuentro sexual y compatibilidad condujeron a su creencia que ella debía ser su esposa. Una discusión del tiempo antes de que Ricki se junte con Marina es necesaria descubrir su origen.

La primera secuencia de escenas demuestra Ricki como hombre de la reparación que se llame para ver al director; él aparece en su oficina y ella lo alerta de su libertad del hospital. Él comenta que él la faltará; el espectador entiende que una relación pudo haberse convertido. Corte a la escena siguiente y Ricki está parado detrás del director, acariciándola. Paul Smith Julian observa en su libro *Desire Unlimited* que en el intercambio para los favores sexuales, Ricki fue dado la ocasión al reintegrar misma en sociedad. Observe que él está procurando recibir normalidad, para que la ocasión esté con Marina. Ricki then leaves the hospital and heads to find Marina when he makes a detour to buy her a heart shaped box filled with hazelnut chocolates. Ricki entonces deja el hospital y trata de encontrar a Marina, cuando él hace un desvío para comprarla una caja formada como una corazón llenada de los chocolates de la avellana. Este gesto se parece agradable, pero el restos de las audiencias inconsciente en cuanto a quién Ricki planea al regalo los dulces. Ricki acecha a Marina en el estudio de la película y él pone una peluca robando de un cuarto de preparación. No descuidando tomar a miembros del molde y del equipo los objetos de valor, Ricki manchan su amor de lejos, que está consultando con el director de la película horrorosa en cómo fijar una expresión facial para una escena. La manera de la cual él la mira se asemeja a un asesino serial. Almodóvar

modeló el carácter después del asesino en la película proto-serial *M* (Wu 265) del asesino. Una escena importante en esta película implica el asesino que mira a través de una ventana del almacén y su cara enmarca un anillo de los cuchillos, que simbolizan sus asesinamente deseos sexuales (Wu 265). ¡*Átame!* fija a Ricki mirando a través de una ventana de tienda, pero su cara es anillada con los chocolates en vez de los cuchillos (Wu 265). La búsqueda romántica de Ricki se asemeja a él de una caza serial del asesino para la carne humana. Marina se siente semejantemente, una vez que ella inocente abra su puerta del apartamento en su socio futuro, que ase su animal prisionero para evitar que ella lo ataque. Luchando, Ricki golpea a ella, saliéndola en un estado inconsciente temporal. Mucha gente encuentra esta serie de escenas muy violenta y se justifican estas opiniones. Ricki se identifica como intruso de su acción, pero el amor para Marina lo fuerza formar sus pensamientos románticos. La película progresa para revelar un lado apacible de Ricki hacia su tratamiento de Marina. Los ejemplos están viajando a una vecindad peligrosa de Madrid para obtener los analgésicos de los drogadictos para el dolor de cabeza que Marina tiene, comprando una cinta más suave en la farmacia para prevenir daño a su piel, y robando un coche para ejecutar con éxito su escape a la ciudad natal de Extremadura. Marina empieza a disfrutar a Ricki; una vez que él proclame su amor para ella a primera vista, ella recuerda que él era muy sexual. El momento crucial en la película implica Ricki que revisita el barrio sórdido en donde se venden las drogas ilegales de la prescripción. Cuando Marina tenía un dolor de cabeza, él robó los analgésicos de un vendedor y alcanzó esto perforando al vendedor. Ella lo

reconoce en su segunda visita y una cuadrilla lo daña en su favor. Ricki robado, herido cojea de nuevo al apartamento de Marina, adonde ella limpia sus heridas.

"La única imagen que recuerdo de mis padres es mi madre afeitando a mi padre." –Ricki a Marina.

La cotización antedicha, proclamada por Ricki como Marina, la reina del pornografía cautiva lava las heridas de su secuestrador huérfano amoroso, significa revelaciones vitales a los caracteres (Kinder 224). Los colores verdaderos que demuestran, Ricki racionalizan su conducta abiertamente violenta compartiendo el deseo de incorporar matrimonio. El papeles de los pares mezclan, significando la importancia de ambos socios en la unión moderna. Él desea comenzar una relación que asimile el que esta' creado entre sus padres. En el mismo tiempo, Marina febrilmente besa a su captor, comunicando su amor a él. Un amor sensual que hace escena comienza, donde no el hombre, sino la mujer controla algo el tempo de empujar. Paul Julian Smith postula que es solamente después de este golpeo que los pares felices están permitidos una escena extendida y ruidosa del sexo, que culmina en el orgasmo espectacular para ambos (115). La identidad de Ricki cambió de puesto de la de un hombre sicopático y violento al humano fiel, romántico. Su meta de ganar la afeción de Marina había sido alcanzada y la noción del negocio inacabado desapareció. En su búsqueda para lograr su amor verdadero, Ricki cosechó la atención de las audiencias y se desarrolló a través de la historia para asegurar la realización. Un conclusión feliz se parecía estar en la distancia para Marina y Ricki. ¡*Átame!*

concluye su cuento de Marina y su hermana Lola que encuentra a Ricki en la aldea permanece en Extremadura. Él huyo del apartamento de Lola sin Marina para robar un coche, mientras que Lola entra al apartamento un poco después para encontrar la hermana esperando por la vuelta de su amante. Marina explica la situación a Lola y viajan fuera de Madrid al hallazgo Ricki, que los saluda con los brazos abiertos. La escena final no concluye el sino de la relación del par, sino termina en una nota positiva, pues los tres caracteres cantan una versión española de la canción de Gloria Gaynor que se llama "Sobreviviré" al regreso de Madrid.

No espere que todo dé vuelta encima de rosas, sin embargo, en todas las películas de Almodóvar. Sus películas sacan varias emociones en sus resultados y se forman algo vago para estimular pensamientos de la audiencia. Una discusión digno de proponer presenta el fenómeno del renacimiento de la muerte ilustrado en las cinco películas estudiadas. Por ejemplo, un carácter puede morir, pero otro carácter puede heredar el alma del fallecido. *Hable con ella* saca muchos rasgos de la audiencia, porque los protagonistas masculinos, Benigno y Marco, esencialmente se hacen uno. La enfermera habladora Benigno cae en amor con el paciente comatoso Alicia y la impregna por la violación. Antes de la acción imperdonable, Marco descubrió los planes futuros de Benigno para casar a Alicia y se enfureció, llamándola absurda. Benigno no pudo oponerse a la tentación y tenía cópula sexual con el suyo solamente amor, colocándose en cárcel cuando el personal hospitalario descubrió la amenorrea de Alicia. Marco, un amigo fiel, las visitas Benigno en una prisión de Segovia y la cámara hace alusión a la conclusión de la

película sobreponiendo la imagen de Benigno encima del de Marco, formando una combinación de los dos hombres visualmente. La muerte de Benigno proviene las noticias falsas entregadas por su abogado, la indicación de Alicia dio a luz a un mortinato y permanecido en una coma. Marco se ve poco después de la tragedia en el sepulcro de Benigno, disculpándose por ocultar la verdad de su amigo querido. La audiencia debe notar un cambio en Marco, puesto que él habla libremente a una piedra sepulcral sin vida. La instilidad de las calidades de Benigno adentro de Marco produce a una nueva persona. Alicia, viva después del milagro, también ganó a una parte de Benigno en un sentido biológico y espiritual. Las escenas pasadas en la película suceden en el mismo teatro en donde los dos hombres habían mirado un funcionamiento de Café Müller. Marco ve a Alicia en la interrupción con su instructor de la danza. Él sonríe en las muchachas, significando una atracción al bailarín joven hermoso que recibió otra oportunidad en la vida, los gracias a Benigno.

“De la muerte emerge vida del la, del masculino emerge femenino del EL, del terreno emerge etéreo del lo...”

- Catalina una Alicia y Benigno.

La muerte ocurre en *Carne trémula* poco antes que sucede un nacimiento. Sobre el descubrimiento de que su esposa engañó en él con el vencedor, David llega Sancho, que acaba de experimentar una pelea con la esposa Clara, que huyó. Sancho gravemente herido se enfurece sobre la evidencia de la visión que Clara engañó en él con el vencedor. Ambos hombres viajan a la cabaña del vencedor para enfrentar la más vieja mujer casada y al hombre independiente más joven. El

vencedor, al disgusto de los hombres, no es casero, pero Clara está en residencia. Una juerga de la matanza comienza, pues Sancho encuentra a su esposa. El lanzamiento dos, con David intentando prevenir la violencia. Elena, que caminaba encima al vencedor, oye los tiros y grita. Pasos del tiempo. Después de oír un monólogo por David, que ahora ha viajado a Miami para pasar tiempo con los amigos y se disculpa por sus fechorías a Elena en una letra, el vencedor acomete en el abrigo Elena del niño fundada para llevarla al hospital. Del intercambio del diálogo, se aprende que ella es casi adentro de trabajo. Mientras que en el camino, el vencedor comenta al feto nonato que él crecerá en un rato agradable en España, haciendo una referencia a la vida después de Franco. El nacimiento próximo del niño del vencedor y de Elena es una realización notable para dos individuos que sentían culpables por un periodo de tiempo significativo.

Otro bebé es el asunto de la conversación hacia el extremo de *Mujeres al borde de un ataque de nervios*. Pepa, que revela en el principio que ella debe coger exámenes médicos antes de divulgar al estudio del doblaje, dice reservado a Marisa (la prometida del hijo de Iván que se llama Carlos) de su embarazo. Pepa no requiere ninguna mediación masculina, apenas rescata la vida de Iván en el aeropuerto y conversando poco con él después de que su acto del valor (Smith 104). El despido de su amante anterior prueba que ella está haciendo más independiente. Es una muerte del varón y también de un paso lejos de una hembra dependiente anterior que Pepa incorporó. Pepa progresa, comenzando otra parte de su vida: un renacimiento está sucediendo dentro de ella. Semejantemente, *Matador* apoya la noción que el renacimiento y la muerte poseen una capacidad de

emerger a partir de una persona. Para encontrar una razón en cuanto a porqué María y Diego reciben placer sexual de matar a sus socios prueba difícil. Corbin repasa la película hecha en 1986 en el ensayo *To Love and Kill for Pleasure: Almodóvar's Ludic Matador* y presume que la gente hace lo que ella hace porque es su naturaleza tan complicada a hacer (329). Asesinar a gente inocente fue requerida simplemente para que los dos se realicen cuando ella anheló actos sexuales. La historia presenta varias cajas sin resolver de los individuos matados, algunos de quién fueron encontradas abandonada, a nombre de María, y otros fueron enterrados en la característica de Diego. Antes de su reunión, la pareja sabían a ningunos otros como uno y prosperaron en momentos temporales de placer de las matanzas de los individuos disímiles que se cayeron presa a los avances sexuales entregados. Cuando Diego descubrió que María practicó voyerismo en él y recogió sus remanente de la tauromaquia, él sabía que fueron destinados para matar uno otro, como ese acto trajo la última satisfacción a los necrofílicos respectivos. La secuencia pasada en la película lleva la policía a enfrentar los asesinos resueltos y el estudiante de la tauromaquia de Diego, Ángel, un psíquico, tiene una visión prediciendo el sino del pronto para ser amantes. La escena de amor ocurre en la cabaña de María en las cercanías de Madrid y también coincide con un eclipse. Un eclipse se define como el paso del todo o una parte de un cuerpo a través de la sombra de otro (Greene). En una manera dramática, María y Diego hacen el amor por primera vez, listo para matarse sobre orgasmo que alcanza. Se alcanza la muerte y sus cuerpos sin vida se derrumban sobre la cama, antes de que la policía pueda arrestarlos para el asesinato. Usando la definición de un

eclipse, una metáfora se puede hacer para desenterrar el efecto del renacimiento. Los pares son semejantes y deben abarcar uno que es. El ha tomado otra forma, librándose de sus estados anteriores. La muerte resulta y el revivir sigue en la versión etérea de las dos personas destinadas. Años paseaban antes de que Diego y María se conocieran y sus imágenes de espejo integraran para convertirse en una. Lo complicado atrincherado dentro de *Matador* continúa en su conclusión, puesto que Ángel y otros caracteres favorables tienen situaciones sin resolver. Almodóvar quisiera que el espectador reflexionara la incertidumbre producida en sus películas

porque la vida se cubre perpetuo en misterio. La observación de una película de Almodóvar es compleja a todos los espectadores, independientemente de si son un perito de la casa del arte o un principiante al género. La película no lleva ninguna semejanza a una producción de la superproducción del cortador de la galleta. Qué está confortando incluye las calidades continuamente ejecutadas que ayudan a crear un proyecto que revigoriza, solidificación adicional la marca registrada de Almodóvar, cuyas concesiones incontables confirman que el cineasta todavía no ha alcanzado su clímax cinemática.

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