

The Signal

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The Signal Wishes its Readers a Spooky Halloween!



This Issue of The Signal Contains the Traditional Halloween Story



Fillet of a fenny snake,
In the cauldron boil and bake;
Eye of newt, and toe of frog,
Wool of bat, and tongue of dog,
Adder's fork, and blind-worm's sting,
Lizard's leg, and howlet's wing,
For a charm of powerful trouble,
Like a hell-broth boil and bubble.

Double, double toil and trouble;
Fire burn and cauldron bubble

Mechanisms of Extreme Growth

by Zachary DeVries

On October 2, 2014 the W. M. Keck Center for Behavioral Biology had the pleasure of hosting Dr. Douglas J. Emlen, professor at the University of Montana, who presented research on the mechanisms underlying the extreme growth of specific structures in insects. Emlen received his B.A. degree from the College of Arts and Sciences at Cornell University in 1989 and his Ph.D. degree from the Department of Ecology and Evolutionary Biology at Princeton University in 1994. After completing his graduate work, Emlen served as a National Science Foundation environmental biology postdoctoral research fellow in the Department of Zoology at Duke University from 1994-1996. In 1996, Emlen began his own research program at the University of Montana. He has won a number of awards, most recently the E.O. Wilson Prize from the American Society of Naturalists.

Emlen began his talk with a discussion of exaggerated traits (such as ornaments and weapons) and their general characteristics, which are as follows: 1) they are disproportionately larger than other traits, 2) they show a steep allometric slope, and 3) they have a heightened conditional sensitivity. These characteristics led to the conclusions that there is great intraspecific variation in exaggerated traits and these traits can serve as honest indicators of male fitness (the sex generally displaying these traits).

After describing the general characteristics of exaggerated traits, Emlen next posed the question: how do traits become exaggerated? To examine this question, he used several beetle species with elaborate horn structures, only seen in males. Using this trait, he was able to show that horn size showed a much steeper slope in its scaling with body size than either wing size or genitalia size. This means that as males grow larger their horns grow larger at a much faster rate than other body structures. To determine the underlying cause of these relationships, Emlen decided to investigate insulin as a potential physiological modulator. Insulin has been shown to stimulate the imaginal discs during development, and larger insects generally have greater amounts of insulin than smaller, poorly fed individuals. Therefore Emlen hypothesized that the differential growth of the various tissues (horns, wings, genitalia) could be modulated by differential sensitivity of different tissues to insulin. Using RNAi to knock down insulin receptors, Emlen showed exactly what he hypothesized in the beetles: genitalia and wing size were only moderately affected (lower sensitivity to insulin), while horn size was dramatically affected (high sensitivity to insulin). This allowed Emlen to



Dr. Douglas J. Emlen

conclude that exaggerated traits (in this case horns) are more sensitive to insulin than other traits.

Emlen went on to discuss some of the broader implications of his findings which could provide insight into understanding animal diversity. Through the insulin pathway, Emlen thinks that increased sensitivity could be responsible for all three characteristics of exaggerated traits (listed above). He also discussed how this system effectively prevents cheaters through the following mechanisms: 1) the signal is unfakeable, 2) the signal is conditionally expressed and linked with body growth, and 3) the signal is costly. Also, this honest indicator of fitness allows for choosy females and rival male competition. Emlen also touched on some other exaggerated traits that increase fitness, but are seen in both sexes and discussed how different exaggerated traits are controlled by different pathways. If the trait is sexually selected (hypervariable), he speculates that either insulin is responsible; whereas if the trait is not sexually selected (not hypervariable), it is likely under the control of other genes (e.g. *Hox*). Under these assumptions, it would be very easy to develop these sexually selected traits by simply changing the expression level of a single receptor.



The Dynamics of Cultural Evolution

by Colin Funaro

On October 6th, 2014, the W. M. Keck Center for Behavioral Biology hosted Dr. Marcus Feldman, the Burnet C. and Mildred Finley Wohlford Professor of Biological Sciences and Director of the Morrison Institute for Population and Resource Studies at Stanford University. Dr. Feldman gave an engaging lecture focusing on the interactions between broad cultural changes and cultural and genetic patterns.

He introduced the inheritance of culture in humans with a simple analogy to the animal world. Like animals acquire a taste for certain foods, humans inherit superstitions from their parents. Cultural evolution can then be discussed in terms of cultural niche construction to conceptualize how cultural elements are selected and inherited. Applying Lewontin's influential ideas that organisms construct suitable habitats from bits and pieces of the external world is what Feldman has applied to cultural phenomena.

He also discussed dual inheritance theory, or gene-culture coevolution, as another central concept in studying and understanding heritable cultural phenomena. For example, dairy culture grew to prominence in certain regions of the world because of its coevolution with lactase genes and the strong selective pressures surrounding lactose tolerance. From this point in the lecture, Feldman presented a series of broad summaries about his work in cultural evolution and the various epistatic forces that shape culture.

First, Feldman spoke about the influence of pathogens and their transmission across cultures. In Canada during the height of the fur trade, fur trappers brought tuberculosis, which was rampant and lethal, to the indigenous peoples of Canada. Even though only a handful of fur traders interacted with these communities, they were responsible for transmitting this infection to huge populations of native Canadians. The strain of *Mycobacterium tuberculosis* found in modern Aboriginal and French Canadian communities consists of only one lineage that can be traced back to the city of Quebec as a source population. The cultural patterns of fur traders and the natives they traded with more than one hundred years ago are still having an effect on people living in Canada today.

Feldman moved on to a more current instance of top down epistatic effects on cultural phenomena. In 1979, to curb exploding populations and avoid an overpopulation catastrophe, the Chinese govern-



Dr. Marcus Feldman

ment enacted the one-child social engineering policy. One child was permitted per couple, unless a daughter was born first, in which case a second child could be conceived. For many reasons, including the passing on of family names and the promise of geriatric care, parents began selectively having sons. This and the added financial burden of a second child discouraged female births and the incidence of abortions and negligent care for female children surged. Thus, in addition to diminishing birth rates, sex ratios also shifted from essentially equal male-female proportions to one of the most male biased populations in the world today. With a preponderance of males in the Chinese population, further cultural changes began emerging. Whereas wives traditionally moved into the household of a new husband, now husbands began moving into the households of their wives. On both an individual and population level, the cultural evolution of China was altered by a single governmental policy.

Feldman also presented research on global patterns of heterozygosity and genetic diversity in humans. Using the DNA of 1,839 people from 64 populations across the globe, Feldman used 650,000 SNPs to measure heterozygosity and parse out distinct versus admixed global populations. Populations generally remained distinct according to geographic barriers, but language also acted as a barrier in preventing some cultures from effectively interbreeding. Northern Asians did not mix readily

with populations from China and the South of Asia because of the ancient Turkish and Sino-Tibetan each group spoke, respectively. Meanwhile, the highest rates of heterozygosity were found in Africa, which supports an African origin to human populations. The lowest rates are found in Native American populations and in the Islamic world. A bottleneck occurred during the Native American passage over the Bering land bridge 12,000 years ago, which only allowed a handful of alleles to reach the new world. Low diversity in the Islamic world is most likely due to the effects of traditional family marriage practices thought to help consolidate patchy resources and the resulting lack of diversity due to inbreeding.

Feldman's final example focused on the most inbred population in the world today. The Samaritans have resided in Israel since before 722 BC. Their lineage can be traced through their Y chromosome to the Cohens, the ancient Hebrew

priests. After more than two thousand years of separation from current Jewish populations, the Samaritans have shrunk from a population of roughly one million at the height of the Roman Empire to less than a thousand today. Only four family names have persisted and their endogamous marriage practices have results in an average inbreeding coefficient of 0.6. Health problems and congenital conditions plague the Samaritan population, including Usher's disease, a condition where babies are born both deaf and blind. The cultural traditions of the Samaritans persist despite the negative effects of inbreeding.

During career, Feldman has made great strides in the theories behind cultural evolution and their applications to human populations. His continuing work on human gene-culture coevolution will continue to shape the way we think about changing cultures and human population genetics.

Animal Personalities: Sex, Invasions and Parasites

by Lauren Diepenbrock

On October 16, 2014 the W.M. Keck Center for Behavioral Biology hosted Dr. Andy Sih, Distinguished Professor from the Department of Environmental Science and Policy at the University of California at Davis. Sih's research group studies the evolution of ecologically important behaviors (*e.g.* predator-prey, mating and social interactions) and how these behaviors influence ecological patterns at both the population and community levels.

Sih's seminar explored the concept of behavioral syndromes and how behavioral syndromes of individuals can influence population dynamics within communities. A behavioral syndrome describes the suite of correlated behaviors associated with an individual organism; for example, an individual that is more aggressive than its peers with regards to feeding behaviors also tends to be dominant in a group of its peers, being both sexually aggressive and bolder in the presence of predators. This concept of behavioral syndromes can be applied across species to understand how an animal's personality affects its fitness.

Experimenting with water striders, Sih's research group has been able to tease apart the mating success of individuals based upon behavioral type and social interactions. Through the course of their studies, his group has described the hyperactive male (HAM) behavioral syndrome, and showed that these HAMs tended to be more aggressive than their peers, mated more frequently (though with no discretion as to whom they mated with), and decreased the activity of other



Dr. Andrew Sih

males, thus decreasing the mating success of the less aggressive males. Such males were termed "keystone individuals", as they had a disproportionately large effect on overall group dynamics. Sih's research team also documented social plasticity within groups of water striders and found that there is a direct correlation between the ability to modify behaviors and the mating success of individuals, such that a behavior that might lead to reproductive success in one environment may be maladaptive in another; however, those individuals that could adapt their behaviors appropriately could be successful in either situation.

From these studies, Sih has been able to show that there are ecological implications of behavioral syndromes, describing how behavioral types can have a direct impact on fitness (reproductive success) and that species can differ in behavioral types which may be flexible depending on the individual.

These behavioral types may also play a role in ecological invasions, with dispersal of propagules being dependent upon the behavior of the organism. For example, if a new group of organisms that display bold, aggressive behavioral types were to disperse into a new location in the absence of a predator, it can easily elevate to pest status. However, in the presence of a predator, these new organisms would need predator release to be successful. Bold organisms also have the capability of forcing those that are shy/non-aggressive to disperse, but because of their behavioral type, these organisms are less likely to become pests. This idea was demonstrated in studies using mosquitofish, which disperse depending upon their social or asocial tendencies. At high local densities, social individuals of this taxon do well and asocial individuals are forced to disperse into other areas where there are fewer of the same species, where these asocial individuals perform well. However, the dispersion of asocial individuals into new areas then also facilitates the movement of social individuals, which then perpetuates the cycle.

Behavioral types may also be altered by interactions with parasites which take advantage of social interactions to both spread and move to preferred/ultimate hosts. This phenomenon of a personality-parasite feedback was described using the trematode-killifish system. In this system, bolder, more aggressive fish become exposed to trematodes through their foraging activities. These trematodes then consume the liver and brain of the killifish and alter their behavior to make them even bolder, increasing their parasite load through their increased activity and also becoming more conspicuous to predatory birds, which are the ultimate hosts for the trematodes. These parasites thus increase the predation rate on infected killifish and cause impacts on local ecosystem food web dynamics, behavioral interactions and overall community dynamics.

Behavioral alterations by parasites may also be seen in humans. Sih ended his talk with a discussion on how toxoplasmosis can alter human behaviors so as to make humans engage in more risky behaviors. The protozoan that causes toxoplasmosis, *Toxoplasma gondii*, has been linked to cases of mental disorders such as schizophrenia, increased incidences of infected individuals to be involved in car accidents, and the potential to become a "crazy cat lady" which thoroughly amused both cat lovers and our lab mates.

THE TEMPTRESS

by Robert Anholt

A breathless silence took over the room, a vacuum created by the attention of the mesmerized spectators. Walter Buchmeister stretched out his hand and his fingertips pushed the white bishop halfway across the board.

"White bishop B-6 to E-3," the announcer informed the audience, as a magnetic white symbol representing the bishop was moved across a board on the wall next to the chess table. A wave of surprised murmurs rumbled through the room. Immediately, Boris Karnovsky, as if he had anticipated the move, firmly moved the black rook sideways.

"Black rook G-4 to C-4," the announcer proclaimed. The rapid succession raised the tension among the spectators. Again, a deep silence descended as Walter Buchmeister leaned back in his chair and fell into deep thought.

"Gosh, this takes forever," Lizzie took a deep breath. She was an exceptionally beautiful woman. The features of her smooth, slightly oval-shaped face were delicately enhanced by a touch of dark mascara and light red lipstick. Dressed in a snow-white outfit, tightly contoured to do justice to her shapely hips, and decorated with a row of Mikimoto pearls around her deep-cut décolleté, she presented an appetizing picture of seductive simplicity. The carefully arranged blond bangs curling hesitantly over her forehead gave her a look of irresistible girlish innocence.

Innocent she was not. Orphaned at ten by a tragic plane crash, Lizzie had struggled through a neglected, impoverished childhood under the guardianship of an elderly aunt. She completed her high school education and soon thereafter met a young naval officer with whom she fell in love. He enticed her to come with him to Las Vegas, where he promised to marry her. Arrived in Las Vegas, they checked into a dilapidated hotel near The Strip. The officer wanted to try his luck at the blackjack table and told Lizzie to wait for him at the hotel. She waited all night. The next morning a little boy knocked on the door and handed her an envelope. It contained a letter from her sailor and a hundred-dollar bill. He explained that he had decided to return to his wife and children in San Diego, assured her that he had had fun, and wished her the best of luck. Lizzie felt exploited, disillusioned and enraged. She swore that she would never again let any man take advantage of her. Moreover, she would prey on men instead. She went to the Aladdin Casino, sat down at the roulette table and placed her only money, the sailor's hundred

dollars, on number 19. It was her lucky day, her nineteenth birthday. She won. She left the casino with \$3,600 and started her career as a professional predator. She bought a few elegant but seductive dresses along with some jewelry, make-up and other accoutrements, and transformed herself into a sophisticated lady of the night.

Lizzie moved into an apartment with Marilyn and Jessica, both show girls at The Flamingo, and became a familiar visitor at the casinos and nightclubs. She always left tips for the dealers; in return, they gave her valuable information about the single rich men who were likely to be interested in some female companionship. She quickly learned that the big catch could usually be found at the baccarat table - an Arabian sheikh, an Italian fashion designer, or a German professor. Lizzie chose her victims cautiously. She considered herself not a prostitute, but an artist. Indeed, she perfected her skill of seduction to a fine art. She would exhaustively research the habits and preferences of her victims and observe them for days, or sometimes weeks, before slowly, but unavoidably striking for the kill, at the right moment and the right place. Her affairs were always short-lived. After extracting a diamond ring from a French general, an exquisite wardrobe from a British millionaire, or thousands of dollars in cash from a Chicago banker, she would simply vanish and leave them with an empty, evaporated dream. Her roommates nicknamed her "Lizzie the Temptress."

One night she came home and showed Marilyn and Jessica her latest acquisition, a pair of delicately sculptured jade earrings, the gift of a Japanese business man.

"Gosh, Lizzie, they're beautiful!" Marilyn gasped. "These men must be crazy to spend all that money on you. You're real lucky."

"It's no luck," Lizzie replied, "I choose 'em carefully and I always get what I want."

"Always?" Marilyn asked. "Surely that does not always work!"

"ALWAYS," Lizzie assured her, "I am an expert on men. I can get them to do anything for me. I can take a man to the roof of the Hilton hotel and when I say 'jump', he'll jump."

"I betya I can find a man who is immune to your temptations," Marilyn persisted.

"All right," Lizzie said boldly, "Whaddoyawanna bet?"

Marilyn had not seriously considered a real bet, but pride prevented her from backing down.

"I bet my Porsche against your jade earrings that I can find a man you have no chance with."

Lizzie had not expected escalation to such stakes. She thought for a moment. She liked Marilyn's sporty little

car. Besides, she had not paid a penny for the earrings. She had plenty of jewelry anyway.

"Okay," she agreed, "Who is the victim?"

"Him," Marilyn pointed at a photograph on the front page of the daily newspaper. It was Boris Karnovsky, Grand Master of Chess, who was in town to confront Walter Buchmeister in a game of chess at the Governor's Mansion. A long article described the career of the undefeated Grand Master. It portrayed him as a lonesome, solitary man, a confirmed bachelor with no interest in women, whose attention focused solely on chess. Looking at the photograph of the austere, reserved gentleman, even Lizzie had to admit that it would be a challenge.

"He leaves town soon after the game is over," Marilyn said, putting more pressure on, "so you'll have to work fast." She handed the Porsche keys to Jessica. Lizzie looked her straight in the eye as she took off the jade earrings and gave them to Jessica. The tiger was loose and no one could stop her!

The chess match started the next morning at ten o'clock. Lizzie selected a simple but attractive outfit, her favorite white dress with the Mikimoto pearls. She did her hair and applied her make-up with painstaking precision. She was a perfectionist. Before leaving the apartment she stepped into high-heeled white satin shoes, looked with satisfaction in her elongated bedroom mirror and grinned: "Beware, Boris, here comes Lizzie!"

Even without a formal invitation, she had no problem gaining access to the event. She simply grabbed the arm of an elderly gentleman, said "In here, Daddy," as they walked by the guard and through the door; then she quickly abandoned her perplexed adopted father. At first she watched the match with some interest. She discovered that some pieces moved only sideways, others diagonally. After she understood how each piece could move, she lost interest and waited for the end of the match, when she would unleash her talents on Boris Karnovsky.

The game had gone on for four hours, but Lizzie was patient, like a desert vulture willing to wait, for days if necessary, until its victim is dehydrated to the point of collapse. Finally, Walter Buchmeister slowly moved his bishop back to its original position. Before the announcer could inform the spectators that the white bishop had been moved from E-3 to B-6, Boris Karnovsky quickly moved his knight. Walter Buchmeister sank back in his chair and gazed at the chessboard in disbelief. After a few moments he leaned forward, laid his king on its side and offered his opponent a congratulatory handshake. The room erupted with enthusiastic applause as Boris Karnovsky rose from his chair and bowed affably to the audience. Lizzie quickly got up and made her way through the

crowd to the chess table just as the Grand Master was about to turn and leave the room.

"Oh, Maestro," she squeaked, as she placed her hand around his arm, "That was the most wonderful chess game I have ever seen! It was marvelous how you got that evil king with that clever pony."

"The knight, mademoiselle?" he asked, mystified by her unorthodox terminology, "It was an obvious consequence of the bishop's retreat, a rather classic error which I had not expected from Mr. Buchmeister."

"Me neither," Lizzie concurred, "but, you know, Buchmeister makes mistakes all the time. I'm tellin' ya, I've been watchin' him and he does it over and over again! Either the bishop retreats or he does somethin' stupid with his king. If you ask me, I think he's just incompetent."

Gabbing along, she led him outside with her hand around his arm, and slid beside him in his limousine as if she had known him for years. He was puzzled and overwhelmed by his attractive admirer, but her obvious ignorance of the game and her sparkling chit-chat amused him.

"Oh, Boris, I mean Mr. Karnovski, I mean Maestro," she said, looking at him with wide, ocean-blue eyes, "All my life I wanted to play chess. But I only want to learn from the best. Oh, Maestro, won't you play with me?"

"Mademoiselle," he replied with an amused, benign smile, "chess is the study of a lifetime. And I am leaving town tomorrow. So, I regret to counsel you not to invest your hopes in me."

"But you're still here tonight!" she insisted, "Only one game, that's all I want. It will mean so much to me. Oh, please, Boris, I mean, Maestro."

"Boris is more appropriate than Maestro," he said amiably, "I'm not a musician, after all. Very well then, mademoiselle, I shall invite you for dinner at my suite in the Hilton at eight o'clock tonight and we shall play one game thereafter. Ah, voila, here we are. Au revoir, mademoiselle. Gustav will drive you home."

The limo had pulled up in front of the glamorous entrance of the Las Vegas Hilton and Boris Karnovsky stepped out.

"Where to, madame?" Gustav asked her.

"Oh, just drop me off at The Strip near Caesar's Palace," she replied.

"Better get that Porsche tuned up, Marilyn," Lizzie greeted her roommate as she entered the apartment. "Tonight's gonna be Boris's lucky evenin'." Exultant with anticipated victory she related to Marilyn and Jessica her endeavors toward the ultimate conquest of Boris Karnovsky. Once they were alone in his hotel suite it would be a piece of cake, standard procedure as far as she was concerned.

"How are you gonna prove to us that you really got him in the sack, Lizzie?" Marilyn enquired.

"I thought of everythin'," Lizzie proudly replied, "Look, I've got this little cassette tape. It's real teeny, but very powerful and voice-activated, a present of that man from Singapore I met the other day. I'll carry it in my purse and I'll switch it on just before the big event. You guys can meet me in the lobby of the Hilton at midnight and I'll let you listen to the tape."

"You're only gonna stay with him till midnight?" Jessica asked.

"Of course, silly," Lizzie grinned, "Just long enough to get the Porsche."

Lizzie spent the rest of the afternoon perfuming and arranging her hair, shaving her legs and curling her eye lashes. She selected a forest-green, shoulderless, deep-cut, velvet evening gown, which, when she bent forward to move a chess piece, would afford Boris Karnovsky an uninhibited view between her breasts all the way down to her navel. She applied a balmy perfume behind her ears and in the cleavage between her breasts. She chose simple pearl earrings and a gold necklace with an exquisite sparkling diamond, guaranteed to keep his attention focused on her voluptuous chest. Black stockings and matching leather shoes provided the final enticing accents to her provocative outfit.

That evening she knew that all eyes were following her as she swayed across the Hilton lobby. The bell captain accompanied her in the elevator to the penthouse suites. When she arrived, Gustav, dressed in a black-tie evening suit, opened the door and announced her arrival to his master. Boris Karnovsky, elegantly attired in white tie and tails, greeted her with his characteristic suave elegance.

"Ah, bon soir, mademoiselle, you look ravishing, truly. Gustav, mademoiselle must be famished. Please, invite her to the table."

With an inviting gesture, Gustav showed her into the large suite. It was a microcosm of extravagant luxury. The enormous floor-to-ceiling windows afforded a million-dollar view of the entertainment capital of the world. Lizzie was stunned, looking down at a dazzling ocean of lights, Las Vegas at her feet. Several large aquaria with tropical fish decorated the dimly-lit room. In the center stood a small marble table, on top of which rested an oak chess board with hand-carved ivory pieces. Against the wall opposite the large windows, underneath a crystal chandelier, stood a gracefully prepared table covered with a maroon cloth, a basket of fresh baguettes and an uncorked bottle of Château Lafite. Gustav moved Lizzie's chair forward as she sat down, and handed her a silk napkin, which she unfolded and placed on her lap. Boris Karnovsky took his seat across from her.

“I hope that you do not object to blini with caviar, mademoiselle,” he said. “They are Gustav’s specialty, very delicate and very light.”

Gustav filled two champagne glasses with Dom Perignon and served two elegantly garnished plates with blini and Beluga caviar. The soft buttery blini and the slightly salty caviar, together with the champagne provided an explosion of undescribable taste. They were followed by a superb canard à l’orange impregnated with armagnac and flamed to perfection at the table by Gustav. The duck was served with asparagus tips in an almondine sauce and Duchess potatoes braised in a herb boursin gravy. Gustav poured the Château Lafite for Boris Karnovsky. He tasted it, letting the wine slowly roll around his mouth and sniffing its aroma deep into his nostrils. After it met with approval, Gustav filled the glasses and retired. Lizzie was impressed. Many wealthy victims had taken her to fancy dinner places, but none matched the feast that Boris Karnovsky had prepared for her.

“So, Boris,” Lizzie said as she savored the succulent duck, “how did you get so involved in chess?”

“Mademoiselle,” he replied, “My parents were political activists and were banished to Siberia. I was born near the village of Dzhardzhan on the Lena river. As a child I grew up alone. I had no friends, nobody to play with. I became interested in chess after an old man in the village taught it to me. I practiced day after day, year after year, playing against myself. It was Me against Boris Karnovsky and I have remained my own most formidable rival. I came to understand that mastering chess means mastering the game of life. Anticipating and taking advantage of changing conditions, being able to foretell your opponent’s move, being in control of your adversary’s destiny without him knowing it, that is the power of chess! Many great military strategists were talented chess players; for example, Alexander the Great had a passion for the game. It takes a master to orchestrate his opponent’s defeat with surgical precision. But, the Grand Master, mademoiselle, the Grand Master takes his art one step further. The Grand Master does not anticipate five, ten, even twenty moves. From the outset he has his eye fixed on the horizon like a captain who has his ship’s course precisely charted before it sets sail. Some more vegetables, mademoiselle?”

Lizzie politely declined. “Now let’s move the subject closer to our ultimate goal,” she thought as she asked him, “And how about the ladies, Boris? How come an attractive man like you never got married? I would fall for you in a heartbeat, I sure would.”

“Mademoiselle,” he replied as his brow darkened, “Once I was about to get married. Marissa was her name, the loveliest creature you have ever seen. She lived with her elderly mother not far from Dzhardzhan.

Every Sunday night she would drive in her horse-drawn sleigh to our little cottage and spend the evening with us. I would anxiously await the jingle of the sleigh bells and the heavy step of Donia, her snow-white horse. That one fateful night, may God erase it from my memory, I heard the bells, but I knew that something was wrong. The sleigh had stopped, but Marissa did not knock on the door. I stepped outside into the freezing night and saw Donia hitched to an empty sleigh. The loyal horse had found its way by itself. I jumped in the sleigh and drove back all the way to Dzhardzhan, following the sleigh tracks. I did not find Marissa that night, nor ever thereafter. Nobody knows what happened to her, whether she was devoured by wolves or abducted by itinerant Mongols. Although she vanished from my life, I vowed that I would forever remain married to her in spirit, and I have never broken that vow, mademoiselle. Every chess game I play, I dedicate to her. Her spirit is bonded to mine through the noble game of chess. I have sworn that I will never be vanquished on the chessboard, or will pay for it with my life. But enough of this somber conversation, mademoiselle! Gustav, fill the glasses!”

“Devoured by wolves or abducted by itinerant Mongols; how awful!” Lizzie thought. It had been many years since Lizzie had felt ashamed and embarrassed. His somber soliloquy made her feel like a pagan grave robber desecrating the tomb of an ancient pharaoh. His pure, unwavering devotion, his deep unshakable love, a love she had never known nor ever would, had touched her deeply. She was confused. Should she continue with her devilish ploy or simply treasure the evening’s experience as a precious memory, one which might restore her trust in the loyalty and decency of man? But what would she tell Marilyn and Jessica? That she had failed? That she simply could not do it?

“Let’s not be sentimental, Lizzie,” she said to herself, “Life goes on. Besides, some sex will do him good after all those years of moping.”

Meanwhile, Gustav served Crepes Suzette on a silver platter and poured her a cup of coffee and a glass of Grand Marnier.

“Café noir, Madame?” he inquired.

“Sure,” she replied timidly.

Gustav dipped a Havana cigar in Benedictine and handed it to Boris. He lit the cigar and the aroma of fine tobacco and exquisite liqueur filled the room.

“Shall we?” Boris said as he pointed to the chess table.

He offered Lizzie his arm and led her from the dinner table to the marble chess table in the center of the suite.

“The lady shall play with white. May I suggest an Italian opening?”

He showed her how to move the pawns and position the knights to initiate the game. He sat across from her, erect and majestic, a master of his craft. When he touched the pieces, he moved his hand gracefully, yet forcefully, like Horowitz striking a chord on the piano, like Picasso brushing the paint on his canvas. Lizzie bent over deeply and displayed the appetizing panorama of her cleavage with every move she made. But his eyes remained focused on the chess board.

"You have quite a flair for the game, mademoiselle," he complimented her as he conquered one of her pawns.

As the game proceeded, Lizzie lost piece after piece, but she managed to keep her king alive.

When her army of chess pieces had been thinned considerably, Gustav approached his master, handed him a glass of cognac and asked for permission to retire for the night. Lizzie suddenly became aware that it was already eleven o'clock! In one hour Marilyn and Jessica would be waiting in the lobby downstairs, eager to hear the details of her conquest. It was time to hurry! But she had to finish the game before she could orchestrate the seduction of Boris Karnovsky.

It was his move. She wished he would finish her off quickly.

"I shall retreat my bishop, mademoiselle," he said with a shrewd smile.

Immediately, without paying the slightest attention to the arrangement of pieces on the board, Lizzie moved her knight forward.

At that moment, Lizzie was about to learn how our smallest, seemingly most insignificant actions, can have profound and unexpected consequences.

Boris Karnovsky, seconds earlier the confident, self-assured Chess Master, stared with bewilderment and panic at the re-arranged constellation of pieces which resulted from Lizzie's move. He placed his fists on the marble table on either side of the chess board and sagged down in his chair. The blood withdrew from his face and his long, pale fingers twitched.

"What's wrong, Boris?" Lizzie asked surprised.

"Checkmate, mademoiselle," he stammered, pointing at her knight. Indeed, his king was threatened by her knight and boxed in by his own pieces without any place to escape. Inadvertently Lizzie had beaten the Master.

"Alas!" he exclaimed with his trembling finger still pointing, "The white horse again! It has returned to announce my destiny! Vanquished, vanquished forever! I can hear the bells! The ax has fallen, the scythe has swung! Forgive me, Marissa! Forgive me, Miss Lizzie!"

After delivering this monologue he extinguished his cigar and, with his cognac glass in his hand, strode out of the room into the adjacent bedroom, leaving the

stage like a grand actor playing the ghost of Hamlet's father.

Lizzie, left alone, sat bewildered behind the marble chess table.

"Gosh," she thought, "he sure is a sore loser. Anyway, men are most vulnerable when they are depressed and he's already in his bedroom. I guess I'll go comfort him a bit, stroke his hair, pat his knee and get it done and over with."

She opened her purse and switched her cassette recorder on.

"Listen carefully, Marilyn," she spoke softly into the recorder, "the Grand Event is about to begin. Here it comes: The Seduction of Boris Karnovsky, Act 1." With her purse clutched in her hand she walked toward his bedroom and knocked on the door.

"Boris, honey, are you in there? Can I come in?"

There was no answer. She slowly opened the unlocked door. She peeked into the room. To her surprise, it was empty. An antique grandfather clock ticked quietly. The curtains fluttered in the warm summer breeze which entered from the balcony, through the open French doors. Boris Karnovsky had vanished. She stepped into the room and walked past the luxurious king-size palanquin bed, through the large French doors and onto the balcony. Looking over the railing she realized how high she was. The swimming pool below seemed like a minuscule clear-blue puddle, the people like dwarfs. Suddenly she became aware of a commotion near the hotel's entrance below her. She saw the flickering lights of a police car and heard sirens. She bent a little further over the railing. There on the pavement, surrounded by a crowd of spectators, she saw a stretched-out figure, sprawled out like a teeny sea star, dressed in what appeared to be white tie and tails. Then she noticed Boris Karnovsky's empty cognac glass right next to the balcony railing. She grabbed the rail, swallowed a couple of times, breathed deeply and tried to keep from swooning. She stepped back through the French doors and leaned against the wall. She re-entered the main chamber of the penthouse suite where the ominous sight of the white knight on the chessboard reminded her of her ill-fated victory. For a few moments she stood motionless. Then she heard an urgent rapping on the door. She staggered across the chamber, opened the door and looked into the pale, petrified faces of Marilyn and Jessica.

"Gosh, Lizzie," Marilyn blurted, "did you do that? Did you tell him to jump?"

"No," Lizzie stammered with a thin, barely audible voice, "honest, I didn't."

Seminars

On **November 3**, 1:30 pm, Dr. Michael B. Eisen from the Howard Hughes Medical Institute (HHMI) and the Department of Molecular and Cell Biology at the University of California at Berkeley and the Genomics Division of the Lawrence Berkeley National Laboratory (Berkeley, CA) will present a seminar titled “Activation of gene expression and the onset of gene regulation in early *Drosophila* development.”

The seminar will be in 3503 Thomas Hall.

Publications

The following publications from the W. M. Keck Center for Behavioral Biology have appeared in print:

Dorris, D. M., Hauser, C. A., Minnehan, C. E. and Meitzen, J. (2014) An aerator for brain slice experiments in individual cell culture plate wells. *J. Neurosci. Methods* **238**: 1-10.

Rutledge, H., Aylor, D. L., Carpenter, D. E., Peck, B. C., Chines, P., Ostrowski, L. E., Chesler, E. J., Churchill, G. A., Pardo-Manuel de Villena, F. and Kelada, S. N. P. (2014) Genetic regulation of *Zfp30*, *CXCL1*, and neutrophilic inflammation in the mouse lung. *Genetics* **198**: 735-745.

Kelada, S. N. P., Carpenter, D. E., Aylor, D. L., Chines, P., Rutledge, H., Chesler, E. A., Churchill, G. A., Pardo-Manuel de Villena, F., Schwartz, D. A. and Collins, F. S. (2014) Integrative genetics of allergic inflammation in the murine lung. *Am. J. Resp. Cell Mol. Biol.* **3**: 436-445.

Griffing, A. R., Lynch, B. R. and Stone, E. A. (2014) Structural properties of the minimum cut of partially-supplied graphs. *Disc. Appl. Math.* **177**: 152-157.

Sullivan, A. W., Beach, E. C., Stetzk, L. A., Perry, A., D'Addezio, A. S., Cushing, B. S. and Patisaul, H. B. (2014) A novel model for neuroendocrine toxicology: neurobehavioral effects of BPA exposure in a prosocial species, the prairie vole (*Microtus ochrogaster*). *Endocrinol.* **155**: 3867-3881.

Diamond, S. E., Cayton, H., Wepprich, T., Jenkins, C. N., Dunn, R. R.; Haddad, N. M. and Ries, L. (2014) Unexpected phenological responses of butterflies to the interaction of urbanization and geographic temperature. *Ecology* **95**: 2613-2621.

Shik, J. Z., Schal, C. and Silverman, J. (2014) Diet specialization in an extreme omnivore: nutritional regulation in glucose-averse German cockroaches. *J. Evol. Biol.* **27**: 2096-2105.

Of note...

Clay Chu served as North Carolina State University's Student Voice Representative at the North American Agricultural Biotechnology Council Meeting on “New DNA-editing approaches: Methods, applications and policy for agriculture”, held in Ithaca, New York. He was also awarded a Southern SARE Graduate Student Grant for developing a novel transgenic control strategy for *Drosophila suzukii*.

Lars Dunaway, James Roberts, Andreas Schmidt, and Leslie Wilson visited Sara Jones' laboratory at Wake Forest University Medical School to learn microdialysis sampling and optogenetics. Lars delivered an electrochemistry lecture to the first year neurobiology graduate students.

Margarita Lopez Uribe received a travel award to present her work on transcriptome-wide variation in the socially polymorphic bee *Halictus rubicundus* (Hymenoptera: Halictidae) at the Ecological Genomics Symposium in Kansas City.

Trudy Mackay was an invited symposium speaker and chaired a session at the EMBO conference on “Experimental approaches to evolution and ecology using yeast & other model systems” at the European Molecular Biology Laboratory in Heidelberg, Germany.

Andreas Schmidt and **Leslie Sombers** presented research talks at BASF in Research Triangle Park (NC).

To contribute to The Signal, to be placed on our mailing list or for information about the W. M. Keck Center for Behavioral Biology, contact Dr. Robert Anholt, Department of Biological Sciences, Box 7614, North Carolina State University, Raleigh, NC 27695-7614, tel. (919) 515-1173, anholt@ncsu.edu.

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