McNair Scholarly Review

a publication of the McNair Scholars Program at

The College of St. Scholastica

© 2013
The College of St. Scholastica, 1200 Kenwood Avenue, Duluth, MN 55811

No part of this journal may be reproduced without permission from the primary author.

The contents of this publication were developed under a grant from the U.S. Department of Education. However, the contents do not necessarily represent the policy of the U.S. Department of Education; endorsement by the Federal Government should not be assumed.

This Ronald E. McNair Postbaccalaureate Achievement Program is 100% federally funded, award P217A120010, $246,400.

The College will not discriminate against or harass any employee or applicant for employment because of race, color, creed, religion, national/ethnic origin, sex, marital status, disability, status with regard to public assistance, sexual orientation, age, genetic information, membership or activity in a local commission, or disabled veteran status.
A Note to Readers

The *McNair Scholarly Review*, published at The College of St. Scholastica and funded by a grant from the United States Department of Education, is a journal comprised of research completed solely by undergraduate students. These students, with guidance from their faculty research mentors, undertook independent, academically rigorous projects which moved them intellectually from beginner to experienced researchers.

Their research varies in subject matter and complexity; the work reflects each scholar’s academic interest. Each article is written in a style appropriate to its field of study, including title and references.

This seventeenth group of McNair scholars have worked hard, stretched their intellect and matured professionally as they moved through the research process. The McNair Program staff at The College of St. Scholastica proudly presents these scholars and their work in this seventeenth issue of the *McNair Scholarly Review*.

Volume 17, 2013
# McNair Scholarly Review

Mary E. Butler, MPA  
Director

Celeste C. Zuniga, BA  
TRiO Program Coordinator

Pamela J. Christensen  
Administrative Assistant

## Faculty Research Mentors

<table>
<thead>
<tr>
<th>Po-Lin Kosuth, MFA</th>
<th>Hong-Ming Liang, PhD</th>
</tr>
</thead>
<tbody>
<tr>
<td>The College of St. Scholastica</td>
<td>The College of St. Scholastica</td>
</tr>
<tr>
<td>School of Arts &amp; Letters</td>
<td>School of Arts &amp; Letters</td>
</tr>
<tr>
<td>Dept. of Communication, Theater, &amp; Art</td>
<td>Dept. of History</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Karen Petersen, PhD</th>
<th>Michelle Robertson, MSW</th>
</tr>
</thead>
<tbody>
<tr>
<td>The College of St. Scholastica</td>
<td>The College of St. Scholastica</td>
</tr>
<tr>
<td>School of Sciences</td>
<td>School of Health Science,</td>
</tr>
<tr>
<td>Dept. of Psychology</td>
<td>Dept. of Social Work</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Shirley Slettedahl, MSA, MSN, RN</th>
<th>Ryan Vine, MFA</th>
</tr>
</thead>
<tbody>
<tr>
<td>The College of St. Scholastica</td>
<td>The College of St. Scholastica</td>
</tr>
<tr>
<td>School of Nursing</td>
<td>School of Arts &amp; Letters</td>
</tr>
<tr>
<td></td>
<td>Dept. of English</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Julie Zaruba Fountaine, MS</th>
<th>Robert L. Lloyd, PhD</th>
</tr>
</thead>
<tbody>
<tr>
<td>The College of St. Scholastica</td>
<td>University of Minnesota - Duluth</td>
</tr>
<tr>
<td>Health Services</td>
<td>Dept. of Psychology</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Michelle Ciucci, PhD</th>
<th>Mustafa al’Absi, PhD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laura Grant, MS</td>
<td>Motohiro Nakajima, PhD</td>
</tr>
<tr>
<td>University of Wisconsin - Madison</td>
<td>University of Minnesota - Duluth</td>
</tr>
<tr>
<td>Dept. of Surgery,</td>
<td>Dept. of Biobehavioral Health &amp;</td>
</tr>
<tr>
<td>Division of Otolaryngology-Head &amp; Neck Surgery</td>
<td>Population Sciences</td>
</tr>
<tr>
<td>Dept. of Communicative Disorders</td>
<td></td>
</tr>
<tr>
<td>Neuroscience Training Program</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>James Dumesic, PhD</th>
<th>Eduardo Maldonado, PhD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elif Gurbuz, BS</td>
<td>David DeHart, and John J. Lemasters, PhD</td>
</tr>
<tr>
<td>University of Wisconsin - Madison</td>
<td>The Medical University of South Carolina</td>
</tr>
<tr>
<td>Dept. of Chemical &amp; Biological Engineering</td>
<td></td>
</tr>
</tbody>
</table>
# TABLE OF CONTENTS

**THE WAR ON DRUGS IN BOLIVIA: The Tenuous Issue of Legalization** .......................... 1

**James B. Arroyo Roppo** ~ History, The College of St. Scholastica

**Chinese Decorative Arts & Culture** ................................................................. 11

**Tara L. Austin** ~ Art, The College of St. Scholastica

**Secondary Trauma** .................................................................................. 17

**Amber J. Cooper** ~ Social Work, The College of St. Scholastica

**Location Danger Assessment as an Avoidance Behavior in Fertile vs. Non-Fertile Women** ........ 24

**Ashley Davis** ~ Psychology, University of Minnesota - Duluth

**Effects of limb exercise on cranial sensorimotor deficits in a rat model of Parkinson disease** ........ 30

**Samantha M. Goode** ~ Biology, The College of St. Scholastica

**Perceived Stress as a Correlate of Cognitive Failures** ................................. 38

**Jessica L. Jorgenson** ~ Psychology, The College of St. Scholastica

**Are Native Americans Conquered?** ........................................................... 50

**Matthew H Northrup** ~ History, The College of St. Scholastica

**Can You See Beyond The Smoke?** ............................................................... 70

**Laurel O. Ohaju** ~ Nursing, The College of St. Scholastica

**Cardiovascular and Cortisol Reactivity and Recovery: Effects of Physical Activity** ............. 87

**Brittanny M. Polanka** ~ Psychology, The College of St. Scholastica

**The Potential Decrease in Learning Due to Competition for Attention** .......................... 99

**Noel R. Reynolds** ~ Psychology/Sociology, University of Minnesota - Duluth

**Quantification of myofilament and sacroplasmic reticulum proteins in transgenic mice overexpressing Ribonucleotide Reductase** ................................. 108

**Stephanie A. Simek** ~ Exercise Physiology, The College of St. Scholastica

**Furfural: A Platform Molecule for Quality Chemicals** ........................................ 113

**Kendra D. Souther** ~ Chemistry/Biochemistry, The College of St. Scholastica

**Role of the Adenine Nucleotide Transporter in Cancer Cells** ............................... 118

**Joseph F. Vuichich** ~ Biology, The College of St. Scholastica

**Novella**

**Lake Shore Driving**

**Shane A. May** ~ English, The College of St. Scholastica
THE WAR ON DRUGS IN BOLIVIA:  
The Tenuous Issue of Legalization  

James B. Arroyo Roppo, History  
Hong-Ming Liang, Ph.D., Mentor  
The College of St. Scholastica  
School of Arts & Letters, Department of History

As South America’s poorest nation, Bolivia’s social strings are tightly wound. A new paradigm in the executive branch; first and only ‘plurinational’ state, as well as massive contemporary ideological shifts in what constitutes el derecho humano. Indigenous identity has surged forward in civic life, as evidenced by the election of Evo Morales, but also the recent events in natural resource nationalization (widely perceived as socialist in nature) extending access and ownership of more and more ‘utilities’ to the indigenous majority. President Jose Evo Morales Ayma might receive an unprecedented amount of attention in news media because of his roles – not least because he is the first democratically elected indigenous president in South America, but he is also head of the Movimiento al Socialismo and the cocalero trade union. In this case, it is prudent to be wary of the legacy of Cold War politics as well as the ongoing United States-led ‘war on drugs’ in Latin America. As significant as the “EVOlution” has been, predictions in 2005 and 2006 by political consultant and Harvard professor David King that Morales’ ascendance would mean a “staggering loss for U.S. anti-drug and pro-trade policies” was reflective of 2005 ‘war on drugs’ zeitgeist, but only as far as pro-trade is concerned; drug policy has a new name (legalization) and a new federal precedent to back up the partially illicit practice of coca chewing with legal framework as well as praxis. What has been shown during his term is that ‘coca’ is separate from ‘cocaine’, and Dr. Waltraud Q. Morales’ assertion that "Bolivian presidents have separated coca and cocaine" takes a new meaning with Morales. I will argue that the war on drugs in Bolivia has undergone a shift in focus (from militarism and eradication to openness towards legalization) not least because of the several reasons delineated – failure of status quo power politics in Bolivia in conjunction with Latin American determinism gaining strength, as well as emerging openness to the viewpoints of formerly subjugated peoples.

Introduction

Turbulence has been the norm for Bolivia for decades. Experiencing over 200 violent and non-violent coups in its contemporary history, determining the next executive power in Bolivia has been no easy task until recent electoral transparency. A turning point was achieved in the 1952 revolution (perhaps the most notable outcome of that is universal suffrage, which greatly empowered the 65-85% indigenous majority) has had its culmination in the first democratically elected indigenous president in the Americas.

Prior to election, the only thing President Morales had going for him was a failed 2002 campaign, a position in the cocalero’s union and a bad reputation with Washington. In
the months leading up to his election, news out of the U.S. covered “Che’s second coming” and charges of narco-trafficking from the State Department and the Pentagon (Reiff) accusations of seeking campaign funding from ‘rogue states’ (BBC) and the undoing of decades of U.S. anti-drug work in the region (King) to ‘simple populist’ seeking to redirect anti-American sentiment for personal political gain. However, according to President Morales, his victory was predicated on “zero cocaine and zero drug trafficking, but not zero coca or zero cocaleros”. In rhetoric, he has consistently defended his public image on the cocaine issue. Ironically enough, he even considers the efforts by his detractors to block his ascendance to office as one of the key factors that propelled him forward.

Section one of the literature review recaps how the various governments of Bolivia from the 1980’s to today have participated and cooperated in varying degrees with eradication and interdiction drug control policies and law, with the understanding that no part of these efforts were truly ‘cooperative’ in nature. Joint efforts such as ‘Snowcap’ and ‘Blast Furnace’ have aimed at destroying coca labs and fields, and others like Law 1008 passed in the Bolivian Congress have criminalized coca production and even regulated the trafficking of ‘precursor chemicals’ involved in the extraction of cocaine from the coca plant. Part two of this section also highlights the importance of race and indigineity in relation to the issue of legalization. Autonomy, nationalization, and classist division all show up in a search for news out of Bolivia, and it seems as if Eastern Santa Cruz and the Western highland create a clean opinion split in most areas concerning how to run a nation and government.

Section two, 'Pachamama on the International Scene', is more suggestive of patterns than conclusionary, and attempts to seat the advent of real legalization effort in Bolivia with the arrival of indigineity in the executive branch and the idea of ‘Pachamama (’mother earth’) on the International Scene’. Basic tenets inform the drug control bodies involved in the debate: care for public health, ethical values, and the fabric of society, as well as innovation in programming; principles agreed upon in the first Summit of the Americas and maintained by the 34 member states, as well as the UN Conventions, U.S. DEA, Office of Nat’l Drug Control Policy and Nat’l Institute for Drug Abuse mandates, as well as Evo Morales’ rhetoric. In this section links are drawn between these tenets and the position Morales has tried to create as an Aymara Bolivian – that not only is the coca plant an important part of public health and the fabric of Bolivian society, but it is crucial to the future success of Bolivia in the global economy.

Literature Review

Tensions in Domestic Drug Control

Yet such is the blundering power of the U.S. that it pressed Bolivia to do its bidding without providing for any realistic alternatives. Tiny programmes of substitute crops that the U.S. authorities on the ground knew to be wholly inadequate were cynically implemented. ...only a few products such as coca leaf can bear the transport costs entailed by this rugged geography.

Jeffrey D. Sachs
1. DEA, Ley 1008, Plan Dignidad, and the UN Conventions

*Soaring heights and bottomless pits*

One of the most influential partners in Bolivian drug control historically has been the United States, who conducted their first drug control operation on foreign soil in Bolivia. The United States view may be as extreme as “…we at USSOUTHCOM view drugs and its movement into the United States as a weapon of mass destruction, and we treat it accordingly” (as cited in Loveman) which was an “off-the-cuff comment” -testimony before Congress in 2004 by current Lieutenant General Benjamin Mixon. More recently, the Obama administration has reaffirmed a strong commit to remaining anti-legalization, but has softened its view on the historically militaristic-nature of drug control conflict.

The August 1983 US-Bolivia treaty set the ground for the next 20 years of cooperation against narco-trafficking, and until President Morales was elected, Bolivian executives have seemingly been ecstatic to cooperate with U.S. drug enforcement operations for generous promises of aid. The operations have had a mixed success rate, ranging from US Ambassador Rocha declaring President and Vice President Hugo Banzer and Jorge Tuto Quiroga respectively as ‘heroes of the War on Drugs’, to the egregious failures that risked lives, aid money, and manifest popular discontent.

In summer 1984 under the auspices of Hernan Siles Zuazo, during his third term of presidency, the precursor treaty to ‘Operation Blast Furnace’ established the U.S. trained Bolivian Mobile Police Unit for Rural Areas (UMOPAR) otherwise known as the leopards, to move in to the Chapare region of Cochabamba and destroy cocaine laboratories and facilities. In 1986 Victor Paz Estenssoro, in his fourth term as president from 85-89 presided over the Bolivian Ministry of Foreign Affairs that approved U.S. support to come in the country and assist the leopards, who were then working in conjunction with the regular military, and so entered the DEA in the form of ~160 U.S. operations specialists, support, advisors, and trainers. 1985 marked the beginning of the joint operations, and in 1988 1,500 armed units entered into the Chapare region of Bolivia to eradicate an estimated 80,000 acres of coca. Word was leaked ahead of the forces however, and traffickers evacuated hours before the forces arrived (Chepesiuk). The Chapare is not a historic area for coca production, but economic maladies from the previous governments, dictatorships and military juntas had sparked a mass migration to the Chapare and other areas to search for new work and many families. Even Evo Morales’ family moved and cut out sections of jungle to raise fruit, grain, and the most economically sustainable plant in Bolivia, erythroxylum coca.

The advance into the new coca producing areas brought up resistance from farmers and peasants, perceived as an attack on them rather than traffickers (Menzel) and the forces were soundly expelled from the region after only 4 months of operation, by locals. Operation Blast Furnace was the first U.S. anti-drug operation conducted on foreign soil, and after the operation ended and was declared a success, the Bolivian government was left to ask the U.S. government for $100 million in aid to compensate for the lost economic activity from the crops that had been forcefully
destroyed, signaling one of the drawbacks of eradication. Future drug control in Bolivia would look more critically at the idea of alternative crop substitution, payment for cooperative eradication, and even voluntary eradication. (Chepesiuk).

From 1987 to 1994, three Bolivian presidents (Paz Estenssoro, Jaime Paz Zamora, and Gonzalo ‘Goni’ Sanchez de Lozada) cooperated with the DEA in Operation Snowcap, which focused on cocaine and chemical interdiction (supply disruption) as well as destroying cocaine labs and arresting suspected traffickers, and spanned nine Latin American countries. Part of what provisioned authority for Op. Snowcap in Bolivia was Ley 1008, passed in 1988 as a codified commitment to the War on Drugs and eradication policy. Though none of the 149 articles proscribe the use of force and eradication in Bolivia is supposed to be voluntary, for the two odd decades of drug war prior to Morales, the favored (and technically successful) tactic has been forced eradication. Paz Estenssoro put through the landmark legislation Law 1008, also known as the Law on Coca and Controlled Substances (still in effect in 2012) which recognized less than 30,000 acres as sufficient to meet ‘traditional usage’ demands for coca, and authorized only the forested Yungas area to produce it, leaving other areas that had sprouted in response to demand in a legal limbo.

Paz Zamora (‘89-‘93) was accused of benefitting from narco-trafficking during his presidency, and Sanchez de Lozada (‘93-‘97) suffered drug decertification from the US for noncompliance in the War on Drugs in 1995 following his 1993 comment to Voice of America that the war on drugs should change, that cocaine should be legalized and regulated. The following year the US State Department publically revoked Paz Zamora’s visa due to his apparent relationship with a prominent Bolivian narcotrafficker. This period was one of the worst for Bolivia, the international community had little faith in the Bolivian commitment to eradication. Nonetheless, eradication continued and the crop loss continued to stoke discontent and anxiety with drug control policy amongst campesinos.

Goni had called for the reduction of US involvement in Bolivia during his 1993 campaign, and considered coca a secondary concern (Lehman) to economic stimulation and reformation. Unfortunately the 1995 decertification curbed his vision, forcing him to focus on meeting the U.S. eradication targets by mid 1996, or suffer a full decertification, meaning severe aid cuts, aid that his reform policies were contingent upon. He met the targets, but at the expense of severe public disapproval and the subsequent loss of power to enact his reforms.

In 1997 when Banzer was elected, more red flags went off in Washington because he had a political pact with Paz Zamora, the same president whos visa was revoked the year before. Banzer saw this and immediately embarked on a crusade-like coca eradication program called Plan Dignidad. Rumor has it that the name comes from Banzer’s desire to restore dignity to Bolivia, after spending years as a student in the U.S. he had become weary of being associate with the cocaine trade, by virtue of being Bolivian. The plan focused on eradication and interdiction almost exclusively, but contained an effort to variegate crops so that in the absence of
coca alternatives would provide an income to farmers. Plan Dignidad began with the Chapare region of La Paz — identified by Law 1008 as producing only extra or illicit coca, that which was not destined for 'traditional' consumption.

In 2001, one year ahead of schedule, the Banzer government declared that they had reached virtual coca zero (zero coca) in the Chapare region. Despite this success in the eyes of the U.S. and the international community (former U.S. Ambassador to Bolivia Manuel Rocha declared Banzer and Quiroga heroes of the Latin American drug war) was under pressure from Chapare farmers to resign, and he could not fill a five year term due to lung cancer and resigned amidst mottled success in 2001. Vice President Jorge Tuto Quiroga took office after him, and was held as the responsible party when a Bolivian scientist inadvertently discovered a significant satellite error (satellites were used to monitor the amount of coca) which put the remaining hectares of coca in the Chapare at 6000, not 600, a decimal placement issue remembered unfortunately as the cerito, little zero.

Sanchez de Lozada was elected again in 2002, but was run out of the country due to conflict over the natural gas supply in Bolivia. His interim successor, Carlos Mesa Gisbert had the opportunity to speak before the UN General Assembly, and made this remark foreshadowing the next phase of Bolivian politics:

> If equity is one of the first demands of humanity, there is no better aid than an equitable commercial exchange system. Poor countries demand that our products reach the markets of the rich countries under adequate conditions.

Gisbert twice tendered a resignation to the Bolivian congress, and in 2005 the chief justice of the Supreme Court Eduardo Rodriguez was sworn in and immediately organized the election that was to bring Morales into the office.

2. Demographic and Racial Tension

Indigeneity and autonomy

Popular discontent from failed policies of governments before him is part of what propelled Morales into the presidency; as head of the cocalero union he had witnessed and identified with coca farmers whose crops had been razed, or had been harassed, even killed by anti-drug operations made possible through aid agreements with foreign powers. One story recounted in “Evo Morales: The Extraordinary Rise of the First Indigenous President of Bolivia” by Martin Sivak tells of how in 1981 Morales witnessed drunken soldiers beat and burn a campesino because he refused to admit to being a drug trafficker. Perhaps unfortunately for enforcement agents, the anti-narcotics operations in Bolivia took to heart the assumption that any resistance by farmers was manufactured by narcotraficantes, and the warlike manner they were carried out with did not breed contentment with local indigenous populations (Conaghan and Malloy, Crabtree and Whitehead, Lehman, Loveman). This type of generalization has contributed to an 'us versus them' mentality in Bolivian politics, which makes Morales' position on coca that much more desirable locally.
Evo Morales was inaugurated in 2006, amidst major media concerns as well as concerns from Washington. During Morales’ 2002 attempt at the presidency, former Ambassador Manuel Rocha reminded the Bolivian voters that “if you elect those who want Bolivia to become a major cocaine exporter again, this will endanger the future of U.S. assistance to Bolivia” (Rocha). Those remarks are credited by many, including Morales himself as propulsion for his popularity in both of his elections. Before he was in office Morales was severely scrutinized by the U.S., and his track record with the U.S. is seemingly even worse – in 2008 U.S. Ambassador Philip S. Goldberg was declared persona non grata and expelled from Bolivia, accused of fomenting anti-democratic and anti-governmental sentiments in rebellious areas. In the same year, Morales expelled the DEA from Bolivia, accusing the agency of attempting to control the drug trade for the benefit of the U.S., ignoring its mandate. In retaliation, the Bolivian Ambassador to the U.S. was expelled from Washington.

In 2009, the Bolivian constitution was updated to include a provision that protects coca chewing as an ancestral practice of Bolivians, in direct contradiction to article 49 of the UN Single Convention on Narcotic Drugs (1961) which also provides a maximum crop eradication time period of 25 years, and after that period (if a reservation allowing for this gap was granted) any country involved in illicit crop cultivation is expected to have completely ended that industry. In 2011, Bolivia withdrew from the 1961 UN Single Convention on Narcotic drugs in an effort to draw attention to the traditional uses of coca, and was supported by the UN Permanent Forum on Indigenous Issues.

Though such actions have strained the U.S. Bolivian relationship, Morales has substituted many others for the void the U.S. used to fill, China, Russia, Venezuela, the United Kingdom, Cuba, Brazil, and Chile all partner with Bolivia on many fronts, and is supported by various NGO’s and research institutions globally in his efforts, if not explicitly. In 2009 Morales made a speech to the UN Gen. Assembly, stating his desire to have ‘zero cocaine’ but not zero coca, the same distinction that caused the withdrawal from the 1961 UN Convention. He called for international unity in purpose, cooperation and support in the war on drugs, but asked for serious reform to determine what really works on an international stage – he called for the elimination of UN veto power, and the end of the Cuban blockade, and rebuffed accusations that he encourages the cocaine trade in Bolivia, signaling a large departure from the appeasement style status quo politics of his predecessors.

As of 2011 the U.S. and Bolivia have agreed to normalize relations (U.S. State Dept.) though cooperation may be precluded by both President Obama’s and V.P. Biden’s commitment to oppose legalization in any form. Support for coca legalization does come from supporters of Bolivia such as Cuba and Venezuela however, and the UN Permanent Forum on Indigenous Issues.

Pachamama on the International Scene

The victory for Chapare coca growers and subsequent DEA expulsion have strained the US-Bolivian relationship and when in June 2011 President Morales expressed Bolivia’s intent to withdraw from the 1961 UN Single Convention on Narcotics few parties outside of Bolivia, UN Permanent Forum on Indigenous Issues and the Trans-National...
Institute marked it as a positive occurrence. The hopes associated with the November 2011 normalization of diplomatic ties between U.S. and Bolivia were therefore none too bright, especially when a purported trilateral agreement between the U.S. Bolivia and Brazil to monitor coca was tabled indefinitely.

The purpose of these moves on the part of Bolivia has been to assert sovereignty beyond international influence, but also to defend a cultural heritage that Morales (and most indigenous Bolivians) believe has been wrongly demonized in international law. The only opposition Bolivia offers the UN and the Washington consensus is the unwillingness to provide blind support for the 3 UN Drug conventions and a strangely legalized-blind-opposition to legalization. All four U.S. institutions detailing drug control policy and principles maintain that innovation in control is an essential facet for improving public health, and support for the Bolivian claim that coca does not equal cocaine is not hard to come by, such as the World Health Organization attempt to publish on the health benefits of the plant in its natural form, which was unfortunately blocked from publication in the 1950s. Morales has reconciled his legalization policy with public health, and the shift away from eradication and militarism is his own innovation.

Following public health interest, innovation, reformation, and respect for human rights, Bolivia has reformed its position on coca within what Morales believes to be the spirit of the UN. The UN conventions are living documents, temporal agreements of member states, which are open to revision should circumstances or leadership change. The fact that support for those conventions and opposition to their renegotiation is mandated in certain crucial institutions is one strong reason that coca has remained an article of contention in drug control, and veto power in the UN has made the shift to legalization policy in Bolivia seem futile. Calling for an end to veto power in the United Nations is Morales’ method of fighting for legalization.

In August 2012 Secretary of State Hillary Clinton wished Bolivia a happy Independence Day, adding remarks that “Bolivia and the United States take great pride in our countries’ rich and diverse heritage. ... Respect for liberty and the protection of our rich cultural traditions are at the center of our relationship.” Perhaps this statement is indicative of the future of relations between the two. As stated previously, the suggestions in this paper are transitive – the future depends on the 2012 U.S. presidential election, 2014 in Bolivia, and the efforts and ideas of state and non-state actors who have interests in influencing the global drug trade.
Works Cited

My research process was interesting to say the least. I went through several thesis changes (go figure) and eventually ended up doing what I was told to do, which was focus. I wanted to demonstrate that the recent shift in Bolivian policy to favor legalization was a move that was not a product of ‘radical leftist’ or socialist policy, but a definitively populist move that has its roots in at least 2 of the indigenous identities in Bolivia.

I found many new articles describing the ascent of President Morales, they are primary sources because I saw a general lack of enthusiasm from Western based powers when Morales campaigned – they are the voices who cry out red and Che. Finding Morales was a bit more difficult, but his words are quoted everywhere. More documents on the list state the formation of legalization policy in terms of Morales’ own ideas and beliefs. The remainder of the documents is actual policies put in place by the U.S.

Primary Sources

"Bolivian President Comments on Expulsion of USAID.” La Razon (La Paz, Bolivia) 22 Aug. 2011, Latin America: Newsbank. Web. 9 July 2012


<http://www.drclas.harvard.edu/revista/articles/view/859>


Secondary Sources


Hale, Charles R. Epilogue Fabricant and Gustafson 195-207.


Sologuren, Ximena S. *El Porvenir, the Future that is No Longer Possible: Conquest and Autonomy in the Bolivian Oriente*. Fabricant and Gustafson 68-90.


As a McNair Scholar, I wanted to push the boundaries of my knowledge and artistic abilities through my research. I wanted to explore cultures by conducting extensive research of different art forms. My main focus was on Chinese culture and decorative art. My goal was to push the boundaries of decorative art and conceptual meaning, creating a series of highly dynamic and thought provoking paintings.

I used acrylic paints for their broad range of vivid colors and quick drying quality. My canvas sizes were relatively small, generally 16 x 20 inches in order to convey detailed, complex images in a short amount of time. I consulted a variety of books on Chinese culture, including Chinese kimono embroidery, Chinese embroidery, and Chinese dress. These aided in my depiction of the traditional Chinese motifs and symbols from ancient to modern times. They also enabled me to observe the detail and complexity in each piece of embroidery and artwork that is common in Chinese culture.

I pushed myself to complete as many pieces as possible. After my initial research, I had so many ideas that I felt compelled to experiment. After completing each painting, I showed it to my mentor, Po-Lin Kosuth. Her feedback was invaluable. Because she wanted to let me explore and think for myself, she chose her words sparingly. She encouraged me to work small at first as means to really capture the detail and surface quality in each of my paintings. Eventually, we began experimentation with texture and shine, including the use of metallic paint. I gradually increased my canvas size, though still paid close attention to surface and detail. This experimentation increased my understanding of different textures and mediums. I also learned how to properly stretch my own canvas, which aided in the process of increasing the size of my paintings.

This experience helped me gain a better understanding of how cultures differ in terms of art form, and broadened my knowledge of Chinese culture and decorative art. Po-Lin was a great mentor and cautiously guided me towards personal growth and artistic development. I will carry this knowledge and experience into my future as an artist, and am confident that it will help me in pursuit of obtaining an MFA painting/drawing degree. I hope each painting tells its own beautiful story, and makes viewers interested in and more aware of Chinese culture.

The following pages provide a description of each of the ten paintings I completed for this project: Asian Silhouette, The Tea Party, Below the Ice, Bridge to Tarabithia, Sliced, Green Tara, Water Moccasin, Toad Dancing, Desire Dragon, and Sea Princess.
**Title:** Asian Silhouette  
**Medium:** Acrylic on Canvas  
**Dimensions:** 18 x 24 inches  

Chrysanthemums are a highly used motif in Chinese embroidery and decorative arts. I admire their unique and complex design. They are also my birth flower. I started this painting with spider chrysanthemums, and then created a silhouette to represent a woman. I wanted to have another creature in the painting that could drape across the woman like a shawl, and a snake seemed very fitting. The snake is also a reference to the dragons used in traditional Chinese art. To incorporate some of my own Minnesota heritage, I created bonsai-like antlers atop the woman’s head. This piece helped me explore traditional colors and simple designs used in Chinese art.

**Title:** The Tea Party  
**Medium:** Acrylic on Canvas  
**Dimensions:** 18 x 24 inches  

This painting incorporates many different situations in my life within a highly decorative manner. The underlying theme is culture - both the one I live in and those long gone. This idea came to me while working out on an elliptical with a TV. Because Charlie and the Chocolate Factory was on, I ended up working out much longer than I had anticipated. I was inspired by the scene when Willy Wonka takes a bite out of his daffodil teacup, and wanted to recreate the magical tea party in the form a painting. I brought together a squirrel and his beetle friend, a menacing snake, bonsai-like tree, and the sacred Resplendent Quetzal from the Mayans. These diverse symbols are meant to remind us of how we may all live in harmony.
Title: Below the Ice  
Medium: Acrylic on Canvas  
Dimensions: 18 x 24 inches

It was a cold, snowy day, and I was longing to go ice fishing. My icehouses combine architecture from the Chinese and European cultures. The White Pines are like those along the Canadian border, and the trout are colored like those in tropical reefs. The decorated border between water and air symbolizes the extreme difference among all of earth’s elements, yet the beautiful secrets that each holds to explore.

Title: Bridge to Tarabithia  
Medium: Acrylic on Canvas  
Dimensions: 16 x 20 inches

According to the Chinese zodiac, I was born in the year of the horse. Waves from Asian cultures have incredibly unique characteristics; I wanted to recreate this as though it was part of the horse’s mane. The horse’s tail forms a bridge that takes the viewer’s eye over to distant hills. A cherry tree blossoms in great detail and completes the colorful environment. I used a book on kimono embroidery and previous sketches to guide me.
The pineapple is a universal sign of welcome and hospitality. More contemporarily, the pineapple is home to SpongeBob Squarepants, and reminds me of past vacations. I painted a pineapple sliced in half, showing its inner fruit and beauty. I included a Chinese inspired floral motif, along with a more American floral branching off the canvas. I also incorporated a necklace, as though it is a garnish to the pineapple’s being. A decorative Chinese bird finishes and completes this creative, funky painting.

This painting is the result of a pleasant mistake. When I started the background and had a few colors on the canvas, my water cup tipped over and spilled all over the canvas. Instead of wiping it up and starting over, I swirled the water and paint across the canvas with my hands, and used my fingertips to create texture. The design is about the Buddhist image of the “Green Tara” god. In order to create a depth in the landscape and to channel the decorative art theme, I used metallic paint to give the painting sparkle.
Title: *Water Moccasin*
Medium: Acrylic on Canvas
Dimensions: 16 x 20

I started this painting without a clear vision of exactly what I wanted to paint. I let my ideas come to me as I painted. In the background, I used vivid colors. I also used intense yellow and red, which I usually avoid, but chose because of their frequent use in Chinese art. This painting really combines all of my recent paintings into one. To create an ominous feeling, I included a snake that that seems to be preying on the beautiful phoenix.

Title: *Toad Dancing*
Medium: Acrylic on Canvas
Dimensions: 16 x 20

My artistic mentor encouraged me to incorporate images and symbols from my childhood into my paintings. I remember stepping on a toad when I was really young, and this rather disturbing image has always stayed in my mind. This image inspired a painting of a toad with a being dancing on his back. I also drew upon my memories of Grand Marais and the Beaver House Bait Shop with a fish head sticking out of the building. This is reflected in the Asian carp and the building structure. The commercial fishing business in Grand Marais inspired the people in a boat and nets. After working on this painting for some time, it reminded me of the Matisse painting “Joy of Life”, which I have always been fond of.
Title: *Desire Dragon*
Medium: Acrylic on Canvas
Dimensions: 16 x 20

I wanted to have a dragon represented in this image before I started painting. I thought about how skeleton images are seen in many different cultures, especially the Hispanic Heritage. Finally, I considered how some of our desires are almost like a sickness; this painting turned into a struggle between good and evil. It proved a good medium to show the yin and yang, another dominant symbol in Chinese culture.

Title: *Sea Princess*
Medium: Acrylic on Canvas
Dimensions: 16 x 20

This is a fantasy image of a “Sea Princess” escaping from violent waters in a relaxing seat upon a turtle’s shell. I thought about how the Ojibwe culture believes that the world was created on a turtle’s shell. I used a lot of Chinese symbols and designs such as the one reflected in the fish’s eyes and in the sky; a symbol of longevity in Chinese culture.
Secondary Trauma

Amber J. Cooper, Social Work
Michelle Robertson, MSW, Mentor
The College of St. Scholastica
School of Health Sciences, Department of Social Work

ABSTRACT

Through conducting secondary research throughout scholarly journals it was found that secondary trauma has a large physical and psychological affect on human service workers. Burnout is a large symptom of secondary trauma and it can be seen throughout many human service workers. Steps can be taken to mitigate potential adverse affects of secondary trauma. By compiling multiple scholarly journals it appears that secondary trauma has a very large affect on human service workers.

Methods

To gather information for this secondary research I searched key words in research database services. Those keywords included secondary trauma, work related fatigue, mental exhaustion, human service evaluation, job stress, and professional burnout. From those seventeen were found that fit the topic of secondary trauma among human service workers. Each scholarly journal was read and their contents were placed into categories that correlated with the secondary research topic. The articles were quoted and paraphrased throughout the secondary research to compile similar research in hopes of bringing multiple research articles together to support the fact that secondary trauma is a issue for human service workers.

Introduction

It was noted at a domestic violence agency that there was a high turnover rate of staff and supervisors. This lead to questioning whether the burnout rate was similarly high across the United States and even across the world. This curiosity lead to the study that explores the impact of secondary trauma as reported in scholarly literature. It attempts to note that the burnout rate is high across the world for human service workers and shows that it is potentially from secondary trauma. The amount of literature on this topic is limited when isolating the topic to just human service workers. Therefore, it became appropriate to note the connection between burnout and secondary trauma. The connection is overwhelming and was shown over and over in other careers but there is very limited amount of research specifically with human service workers.

Secondary trauma and burnout is a moderately unexplored topic and by bringing the literature forward that has highlighted the effects on advocates, discussion and even further research can have a platform to continue from. For the purpose of this literature review secondary trauma and burnout must be defined. For purposes of this review burnout is defined as physical or mental breakdown that has originated at the workplace. Secondary trauma referred to in this review is an
indirect exposure to trauma through helping an individual who has went through a traumatic even firsthand.

Social workers have a broad range of responsibilities and tasks. They play a critical role in the well being of some of society’s most vulnerable people. Their high demand job requires them to be present for people both physically and mentally. However, the high burnout rate coupled with the diminishing funds and services has made it a very hard occupation for those individuals who are currently in a human service career.

There are very few articles written about the affects of secondary trauma or burnout, especially in reference to advocates. However, the affects of secondary trauma and burnout, no matter the profession can be shown to be very similar across the world. No matter the geographical location or the occupation secondary trauma and burnout have huge impact on human service workers across the world. A study conducted in France reported that caregivers who had the highest work related burdens reported significantly worse health than others who are not caregivers. The authors conducted a cross-sectional analysis from a Gazel Cohort study and their findings “supported the hypothesis that caregiving can have positive effects on health, provided that caregiving activities themselves are not too heavy a burden” (Andrieu, Ankri, Bonenfant, Bonnaud, Boumendil, Buyck, et al. 2011, p.2). Thus presumably leaving the opposite also true, caregiving can have a negative impact on health provided that caregiving activities themselves are a heavy burden.

It is important to acknowledge that many of the studies made note that we cannot group all human service workers in the same category. The stress of secondary trauma and the effects of burnout largely affect human service workers as a whole but how each individual reacts to it may differ. An article in the American Journal of Public Health stressed the “importance of considering caregivers not simply as a homogeneous group in terms of risks of adverse health events but rather a complex population with levels of risk that vary according to the way they cope (physically, mentally, and emotionally)” (Andrieu, Ankri, Bonenfant, Bonnaud, Boumendil, Buyck, et al. 2011, p.8). Every individual reacts differently to their surroundings, but it is important to be aware of the commonalities in a specific population, such as human service workers, to promote positive change.

One study had interesting results that suggested that secondary trauma may be something that individuals who work for an extended period of time in human services may be able to work through and overcome. The study did not separate by age but by amount of years working in the career. The results of their study suggested that “having a longer career in mental health confers less emotional exhaustion and greater sense of personal accomplishment” (Bebbington, Johnson, & Nelson, 2009, p. 548). These results may be explained by people who tend to leave the occupation quickly because it is having a negative effect on them. It could also be explained that confidence and coping skills may be something that is learned with enough experience. This study leaves the door open for future studies that could explore if the individuals who have been in
the career longer have self care plans or what methods they have learned, if any, to cope with their demanding occupations.

Researchers in Sweden created a measuring instrument based on clinical criteria for exhaustion disorder including burnout, anxiety, and depression. Their tool yielded results that showed individuals with high ratings of self reported exhaustion disorder had a higher correlation to poor work ability. The article implied “that employees reporting in accordance with the [exhaustion disorder] criteria are likely to perform below their normal capacity to work” (Ahlborg, Glise, Hadzibajramovic, Jonsdottir, 2010, p. 518). Their instrument captured “potentially severe stress-related mental exhaustion present in a population of human service workers who are occupationally active” (Ahlborg, Glise, Hadzibajramovic, Jonsdottir, 2010, p. 517). This is cause for concern because it brings forth a harsh reality that human service workers may be helping others, but in turn harming themselves.

The issue of burnout should be addressed because the high cost that burnout can have on organizations, the physical and mental consequences it has on human service care providers, and affect it has on those individuals seeking help from the human service workers. The high cost of training new employees because others have left and the cost of mental and physical doctors for employees who are burnt out alone is a huge expense that could possibly be alleviated if the issue was further addressed.

Researchers from the University of Copenhagen, Denmark investigated in a study for three years to what extent psychosocial work characteristics predict absence in human service professionals do to sickness. Their scoring scale showed a correlation between absence due to sickness and the 16 different work characteristics analyzed. “There was a clear trend that a worsening in the psychosocial work environment index predicted increases in sickness absence” (Borritz, Bultmann, Christensen, Kristensen, Rugulies, & Villadsen, 2007, p.302). In short, work related burnout was a strong predictor of future absences due to sickness. “Exposure to violence and threats from clients during the previous 12 months was one of the strongest predictors for future sickness absence days” (Borritz, Bultmann, Christensen, Kristensen, Rugulies, & Villadsen, 2007, p.305). The correlation does not prove causation but it supports the notion that poor work environment and exposure to violence may be a contributing factor to burnout.

Another study in Sweden explored the factors associated with social workers leaving their place of work. They distributed a questionnaire to 309 social workers who worked in child welfare. The study acknowledged that “although the situation in Sweden does not seem to be as serious as in the USA or in Great Britain, there is no reason to believe that the process behind turnover should differ among these countries” (Tham, 2007, p. 1233, 1235). They also acknowledged that turnover differs between every person, occupation, and many more factors but there are some consistent predictors. One interesting find from this study was that only about twenty five per cent of the workers had been at their current workplace more than five years. Ninety five percent held at least a bachelors degree in social work. However,
nearly half of the participants replied that they “fairly likely or very likely would actively seek a new job within a year” (Tham, 2007, p. 1233, 1235). Nearly half the workers would seek another job opportunity within a year. Workers could be leaving their jobs for a multitude of reasons but only twenty five per cent of the workers had been at their current job for more than five years yet nearly half would actively seek opportunities to leave. Every individual has their own personal reasons to leave but the turnover rate in human service workers is unbelievable and instead of ignoring the issue it is important to bring it forward and acknowledge there is a problem in order to seek a solution.

Work related exhaustion for human service care providers is a crucial issue because it can unfavorably affect the quality and consistency of social services. The risk of depression and other psychological distresses increases among human service care providers who are experiencing work related exhaustion. An article showcased substantial evidence on how burnout can greatly affect an entire countries workforce. It may not be news that burnout is high among social workers. Yet, despite all this, little is known about its impact on the physical health of social workers (Ji, Kao, Kim, 2001, p. 2-7). Burnout not only increases the risk of leaving the job, it increases the risk of the workers physical and mental health.

A study conducted in California revealed that burnout can adversely affect the physical health of social workers, with higher levels of burnout leading to more physical health problems one year later after initial assessment. The research also “found that social workers with higher initial levels of burnout reported more headaches, gastrointestinal problems, and respiratory infections a year later” (Ji, Kao, Kim, 2011, p. 2-7). These results illustrate the importance of not only acknowledging burnout is a issue for organizations but it is also spiritual, physical, and mental issue that sticks with human service providers potentially for life.

It is also important to recognize who is most at risk of burnout. Other researchers from the College of Social Work, University of Kentucky who studied the possible causes of burnout found in their hierarchical regression analyses “that younger age, having no special trauma training, having an increased percentage of individuals on the caseload with PTSP, being an inpatient practitioner, and not using evidence based practices significantly predicted burnout” (Craig, Sprang, 2010, p. 334). All these contributors may put a person at a higher risk of becoming burnt out however a study conducted in Munster Germany by the Department of Psychology provided “an initial empirical glance on the general relationship between age and strain as a function of three different age-related processes. First, older workers might be more resilient to daily stressors compared to their younger colleagues because of better emotion regulation. Second, older workers might be more vulnerable to stressors compared to younger colleagues because of higher depletion and decrease in physical resources. Finally, age and strain might be non-linearly related in an inverted U-Shaped pattern because of contextual demands that are highest for middle-age workers” (Hertel, Rauschenbach, 2010, p.56). Thus, burnout is an active risk for all human service workers no matter their age. Every age group has contributors that could
increase the likelihood of burnout and therefore everyone should actively participate in activities to prevent it.

An article affiliated with The National Institute of Occupational Health in Denmark found that all scales on demands at work and the scales on role conflicts correlated positively with work burnout. It is important to note that these associations do not establish causal associations. However, the correlations indicate that it is worthwhile to pursue analyses of the impact of psychosocial work environment factors on burnout further, when prospective data are available. “With regard to consequences of burnout, we found a linear association between burnout levels and numbers of sickness absence days. As with determinants of burnout, this does not establish causality, but it encourages further prospective research” (Bjorner, Borritz, Kristensen, Mikkelsen, Rugulies, Villadsen, 2006, p. 54). This article showed how important it is for organizations to seek self care plans and other things that could promote healthy living for human service workers because it could not only positively affect the amount of money spent on medical bills, it could improve the work ability of their employees.

A study on the influence of a disaster on the health of rescue workers yielded interesting results that may not be directly correlated to burnout of human service workers but the findings of the study could possibly suggest further study is needed in this area. The study found that psychological reactions such as posttraumatic stress disorder and burnout increased the number of sick days following a traumatic event. The study found that because of the trauma event the increases in psychological problems, as well as respiratory, musculoskeletal and nonspecific symptoms, emerged immediately. However, for psychological problems, these increases persisted for years. For psychological problems, a much greater increase in sick days was found, which persisted until the end of the study period (Dirkzwager, Kessels, Morren, Yzermans, 2007, p. 1282). The findings of the study showed that the physical repercussions of the job withered away after period of time. However, the psychological consequences lasted for an extended period of time. This study can correlate back to the topic of burnout and metal exhaustion because it shows that the psychological consequences of the workers lasted far longer than the immediate physical consequences (Dirkzwager, Kessels, Morren, Yzermans, 2007, p. 1282).

Acknowledging there is an issue is a huge first step, however finding solutions or at least some form of prevention would be highly beneficial. A three year study of the relationships between coping, job stress, and burnout found that the physicians who sought out counseling interventions significantly reduced the level of emotional exhaustion, job stress and emotion-focused coping seen after one year (Aasland, Gude, Hoffart, Isaksson, Tyssen, Sexton, 2010, p. 9). This article suggests that seeking counseling could potentially alleviate the harmful affects of stressful jobs. This particular article showed that seeking professional mental treatment is beneficial but it could be valuable to attempt to find other ways such as team meetings or other intervention methods that could promote a healthier lifestyle for human service workers.
No matter the cause of burnout there are intervention practices that could potentially lighten it. Lightening the affects of burnout would benefit everyone involved in either working in human service or receiving human service services. These advocates, social workers, and all other care providers are continually giving their all to help others and it is now shown with no doubt that there are consequences both mentally and physically for the employees.

This review attempts to minimize any doubt that there are mental and physical consequences so that further attention can be given to possible intervention plans. Human service workers are some of the most giving and caring people and preserving their health should be a huge priority. There is an abundance of research on the recipients of care from human service workers but there is only a minimal amount of research done on the caregivers themselves. Although the recipients of these services are extremely important, if there is a continuance down this “self destructive” path there will be little to no care providers left.

Human service workers need to start taking care of themselves as much as they care for others. As previously stated there are huge consequences if burnout and other emotional exhaustion side effects are ignored. It may just seem like a small issue but over the course of an entire career human service providers are suffering huge consequences to care for others. It is now our turn to find possible ways to prevent this from continuing.

References


Introduction

Evolution by natural selection is a centuries old theory; it is also the only known scientific theory that can explain the astounding diversity we see around us today. More and more scientists are using the evolutionary paradigm to examine human behavior. Evolutionary ideas have become especially prominent in the field of psychology, allowing for the development of novel hypotheses and promoting new areas of research.

Evolutionary psychology attempts to identify a likely recurrent adaptive problem faced by humans over evolutionary history. Knowledge of this likely adaptive problem is then used to infer the nature of a current psychological mechanism (McKibbin & Shackelford, 2011). A psychological mechanism is defined as a series of actions within an organism which are designed to take in a particular piece of information and create a solution that has historically helped to solve an adaptive problem. A psychological mechanism exists in organisms today because it solved a specific threat to the organism’s ancestors across evolutionary history, ultimately leading to the survival of the species (Buss, 2012).

There are several psychological mechanisms that have been hypothesized and researched by many evolutionary psychologists; of particular interests are those pertaining to rape-avoidant behaviors and ovulatory cues.

A recurrent adaptive problem that females of all species, but especially humans, have faced over evolutionary history is rape. In humans rape of women by men has occurred throughout recorded history and across cultures. Rape is a strategy aimed directly at obtaining reproductive resources at a cost to the victim (Duntley & Shackelford, 2008). Rape causes women not only extreme psychological and physical costs, but it also has reproductive and fitness costs (McKibbin & Shackelford, 2011; Duntley & Shackelford, 2008). By bypassing female mate choice, rape reduces the likelihood that a female and her offspring will be provided for and protected from threat. Thus in order to protect the survival of our species, it is plausible that females developed specific psychological mechanisms that promote rape-avoidant behaviors.

Research indicates that attractive women of reproductive age have likely evolved several psychological mechanisms which promote rape-avoidant behaviors. In a study by Thornhill and Thornhill (1990) research provided evidence that the psychological pain women experience after being raped may be one trait which promotes rape-avoidance. They argued that psychological pain leads women to focus on the circumstances surrounding the rape and
avoid such circumstances in the future. Another study examined the performance of risky behaviors throughout the menstrual cycle. Chavanne and Gallup (1998) found that females in the ovulatory phase of the menstrual cycle performed fewer behaviors which could be connected to a greater risk of being raped, in comparison to behaviors with lesser risk of being raped. This study was replicated in 2003 by Broder and Hohmann and results indicated that women selectively avoided performing behaviors connected with a greater risk of rape when most fertile. Yet another study was conducted by McKibbin et al (2009) in which researchers found that women were likely to avoid strange men, avoid appearing sexually receptive, avoid being alone, and increase their awareness of their surroundings, all of which are behaviors which women hope will reduce the likelihood of rape occurrence. All of these studies indicate the presence of psychological mechanisms which motivate female behaviors to avoid circumstances in which it is likely a rape would occur.

In contrast, other researchers have found that females make themselves more physically attractive during ovulation, either unwillingly or physically. In one such study conducted by Roberts and his colleagues (2004) both male and female participants were asked to rate a series of photos containing female faces taken during both ovulation and non-ovulation periods. Participants rated the faces of females who were ovulating as more facially attractive than the faces of the women who were not ovulating. In addition to this study, another study found that females were more likely to put more effort into their appearance when ovulating than when not ovulating. This extra effort manifested itself in the form of attire as well as cosmetic application (Haselton et. al, 2007).

As indicated above there is some disagreement in the research surrounding behaviors linked to rape occurrence. The purpose of the study at hand is to further examine psychological mechanisms which may decrease the risk of rape. This study focuses on stereotypical risky locations for women to be alone in. I hypothesized that as a means to reduce personal risk of rape females will rate locations as dangerous, but 1) females on hormonal contraceptives will rate locations not quite as dangerous as females not on hormonal contraceptives and 2) females not on hormonal contraceptives will rate locations as more dangerous while ovulating than when not ovulating.

**Methods**

**Participants**

Data for this study was gathered from a sample of 296 female students recruited from psychology courses at the University of Minnesota Duluth, of which 237 participants had valid entries to be analyzed. Participants ranged in age from 16 to 41 years old. The mean age of participants was 18.9 years (SD= 2.925).

Participants were asked if they were on hormonal birth control (the pill). 133 participants reported they were on such medication. 104 participants reported not being on such medication.

**Procedure**

Prospective participants were given information about the study through the University of Minnesota Duluth Experiment...
Management SONA system website. Upon signing up to participate, subjects were asked a series of questions, instructed to go to www.babycenter.com/ovulation-calculator which would calculate the dates of their next ovulation. Finally, participants were shown a series of photos and asked to rate them based on their level of comfort if they were in those locations. At the beginning of the study, subjects were given instructions to complete part two of the study based on whether or not they were ovulating in this section of the study. Subjects who were ovulating in part one of the study, were instructed to return on a date outside of the fertile dates provided by the Baby Center Ovulation Calculator. Subjects who reported that they were not ovulating during part one were instructed to return on one of the fertile dates given in the Baby Center Ovulation Calculator. In part two of the study, participants were shown the same twenty images and again asked to rate them according to their level of comfort.

Measure

For this study a five point likert scale was used, consisting of very dangerous, dangerous, somewhat dangerous, unsure, and neutral. This scale was used to assess participants’ level of comfort in twenty situational photos. The twenty photos consisted of ten locations likely to be associated with feelings of discomfort, operationally defined as feelings of danger, and ten photos likely to not be associated with feelings of discomfort, which were operationally defined as neutral feelings. Other measures included in this study were whether or not the participant was on birth control, which was assessed with a simple yes or no survey question. Also, participants were assessed on where they were at in their menstrual cycle. This was measured with the Baby Center Ovulation Calculator.

Analysis

This study is a mixed design: within subjects (repeated measures ANOVA), between subjects (factors). The two independent variables are time in cycle (near ovulation, far from ovulation), a within subjects factor, and birth control status (yes, no), a between subjects factor. The critical assessment is an interaction between time in cycle and birth control status.
### Results

#### Descriptive Statistics

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>1=Yes, 2=No</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ONAve No</td>
<td>2.0442</td>
<td>.22009</td>
<td>104</td>
</tr>
<tr>
<td>Yes</td>
<td>2.1015</td>
<td>.31091</td>
<td>133</td>
</tr>
<tr>
<td>Total</td>
<td>2.0764</td>
<td>.27582</td>
<td>237</td>
</tr>
<tr>
<td>ODAve No</td>
<td>3.0500</td>
<td>.76145</td>
<td>104</td>
</tr>
<tr>
<td>Yes</td>
<td>3.4301</td>
<td>.63268</td>
<td>133</td>
</tr>
<tr>
<td>Total</td>
<td>3.3940</td>
<td>.71765</td>
<td>237</td>
</tr>
<tr>
<td>NNAve No</td>
<td>2.0654</td>
<td>.25172</td>
<td>104</td>
</tr>
<tr>
<td>Yes</td>
<td>2.0409</td>
<td>.29220</td>
<td>133</td>
</tr>
<tr>
<td>Total</td>
<td>2.0561</td>
<td>.27256</td>
<td>237</td>
</tr>
<tr>
<td>NDAve No</td>
<td>3.1673</td>
<td>.71461</td>
<td>104</td>
</tr>
<tr>
<td>Yes</td>
<td>3.2211</td>
<td>.58297</td>
<td>133</td>
</tr>
<tr>
<td>Total</td>
<td>3.1975</td>
<td>.64328</td>
<td>237</td>
</tr>
</tbody>
</table>

#### Tests of Within-Subjects Contrasts

<table>
<thead>
<tr>
<th>Source</th>
<th>Type III Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
<th>Partial Eta Squared</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cycle</td>
<td>2.913</td>
<td>1</td>
<td>2.913</td>
<td>.000</td>
<td>.000</td>
<td></td>
</tr>
<tr>
<td>Cycle*BirthControl</td>
<td>.440</td>
<td>1</td>
<td>.440</td>
<td>.456</td>
<td>.036</td>
<td></td>
</tr>
<tr>
<td>Error</td>
<td>20.500</td>
<td>235</td>
<td>89.389</td>
<td>.000</td>
<td>.000</td>
<td></td>
</tr>
<tr>
<td>Environment</td>
<td>351.532</td>
<td>1</td>
<td>351.532</td>
<td>869.336</td>
<td>.000</td>
<td>.803</td>
</tr>
<tr>
<td>Environment*BirthControl</td>
<td>.124</td>
<td>1</td>
<td>.124</td>
<td>.456</td>
<td>.036</td>
<td></td>
</tr>
<tr>
<td>Error</td>
<td>88.108</td>
<td>1</td>
<td>88.108</td>
<td>.000</td>
<td>.000</td>
<td></td>
</tr>
<tr>
<td>Cycle*Environment</td>
<td>1.933</td>
<td>1</td>
<td>1.933</td>
<td>.000</td>
<td>.000</td>
<td></td>
</tr>
<tr>
<td>Cycle<em>Environment</em>BirthControl</td>
<td>.033</td>
<td>1</td>
<td>.033</td>
<td>.911</td>
<td>.522</td>
<td></td>
</tr>
<tr>
<td>Error</td>
<td>18.731</td>
<td>1</td>
<td>18.731</td>
<td>.000</td>
<td>.000</td>
<td></td>
</tr>
</tbody>
</table>

### Table 1

Table 1 gives the means and standard deviation and sample sizes for danger ratings of neutral and threatening environments (N vs. D) given by women on and off hormonal birth control (Yes vs. No), when mid cycle and peri cycle (O vs. N). The means ratings for dangerous stimuli were higher than for the neutral stimuli, but the degree of elevation was less for women when they were mid cycle, irrespective of birth control status.

### Table 2

Table 2 gives the results of a 2x2x2 mixed ANOVA with danger level of stimuli (within subject), point in cycle (within subject), and birth control status (between subject) as the independent variables. Cycle, Environment, and the Cycle Environment interaction were all significant, but Birth Control Status did not interact with these effects or with the 2-way interaction.

### Tests of Between-Subjects Effects

<table>
<thead>
<tr>
<th>Source</th>
<th>Type III Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
<th>Partial Eta Squared</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>6699.729</td>
<td>1</td>
<td>6699.729</td>
<td>12834.093</td>
<td>.000</td>
<td>.982</td>
</tr>
<tr>
<td>BirthControl</td>
<td>.445</td>
<td>1</td>
<td>.445</td>
<td>.852</td>
<td>.357</td>
<td>.004</td>
</tr>
<tr>
<td>Error</td>
<td>122.676</td>
<td>235</td>
<td>.522</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Table 3

Table 3 reflects the absence of a main effect of birth control status on danger ratings.
Figure 1 shows the elevation in danger ratings for dangerous stimuli, and for an even larger elevation when women who are not on hormonal birth control are at mid cycle.

Figure 2 shows a similar elevation in danger ratings for dangerous stimuli, and a similar enhanced elevation when women who are on hormonal birth control are at mid cycle.

Discussion

Previous research has hypothesized the existence of several psychological mechanisms which may increase certain human behaviors. This study focused particularly on psychological mechanisms that may be linked to rape-avoidant behaviors. Particular to this study, overall women rated photographs of dangerous situations as more dangerous than photographs of safe situations (significant main effect of stimulus). In addition, mid-cycle women rated photographs of dangerous as being even more dangerous, whereas their evaluation of safe situations did not change (significant stimulus by cycle interaction). This was found to be the case whether or not the woman was on hormonal birth control (no significant 3-way interaction with birth control status). Point in the cycle selectively affects the perception of dangerous situations irrespective of whether or not this change in status is associated with ovulation and risk of reproduction. These results call into question previous studies where changes in psychological functioning mid cycle have been attributed to a change in endocrine status, and where a control group on hormonal birth control was not compared.

This study was conducted at a Northern Minnesota university which poses several limitations. This study’s results may not be able to be generalized to all females, particularly females in inner city regions. Participants in this study are more likely to be of higher socioeconomic status, as well as of higher intelligence. Participants are also more likely to be of European descent than any other nationality. This study did not address race/ethnic background or socioeconomic statuses which could contribute to feelings of danger in certain locations. Future studies should take into account females race/ethnic backgrounds as well as socioeconomic status.
References


Fessler, D. M. T. (2003). Rape is not less frequent during the ovulatory phase of the menstrual cycle. Sexualities, Evolution, & Gender, 5(3), 127-147.


Effects of limb exercise on cranial sensorimotor deficits in a rat model of Parkinson disease

Samantha M. Goude¹, Laura Grant, MS²,³, Michelle Ciucci, PhD²,³,⁴
¹The College of St. Scholastica
²University of Wisconsin-Madison
Department of Surgery, Division of Otolaryngology-Head and Neck Surgery
³Department of Communicative Disorders
⁴Neuroscience Training Program

Abstract

Parkinson disease (PD) is a progressive neurodegenerative disorder associated with a depletion of the neurotransmitter, dopamine. Deficits experienced by people with PD include bradykinesia, tremor, as well as voice and swallowing dysfunction, which negatively impact quality of life. Current medical treatments are effective at attenuating deficits in the extremities, but not cranial sensorimotor deficits. However, exercise has been shown to be beneficial. The mechanisms underlying the positive effects associated with exercise are not completely understood. In a rat model of PD using the neurotoxin 6-hydroxydopamine, forelimb exercise has been shown to rescue the forelimb behavior as well as the levels of dopamine in the striatum. Similarly, vocalization exercise rescues the behavior; however it is not associated with a rescue or sparing of dopamine. The aim of this study was to see if rescuing forelimb behavior and striatal dopamine with intensive exercise would also rescue vocalizations. The rats were put into two groups: trained (n=8) and untrained (n=8). Results indicate that the trained and untrained groups both showed an improvement in forelimb asymmetry; however the trained group appeared to improve more by day 13. While the average intensity of vocalizations was similar between the two groups, the maximum intensity was louder for the trained group compared to the untrained. Unexpectedly, nigrostriatal dopamine, as measured by the level of tyrosine hydroxylase staining, was reduced to a greater degree in the animals that received training. It is unclear what these results mean; it may reflect the timing and intensity of the forelimb exercise, which are important therapeutic considerations.

Introduction

Parkinson disease (PD) is a progressive neurodegenerative disease associated with widespread loss of the neurons responsible for synthesis and release of the neurotransmitter, dopamine, in areas of the brain including the striatum and substantia nigra¹. PD affects about 2% of the population over the age of 65² and is characterized by peripheral sensorimotor deficits such as akinesia, bradykinesia, tremor, and muscle rigidity³, as well as other non-motor signs, such as balance dysfunction, sleep disturbances, memory impairments, and drooling⁴. Cranial sensorimotor deficits, such as voice and swallowing dysfunctions, are also common and can be extremely debilitating, thus negatively impacting patients’ quality of life⁵. Specifically voice deficits may include decreased loudness, reduced pitch
variability, and a harsh breathy voice quality\textsuperscript{6, 7}.

There is currently no cure for PD, and treatment is primarily aimed at managing symptoms and improving quality of life. Dopamine replacement therapy using the drug Levodopa is highly effective at attenuating motor deficits in the extremities. However, the side effects of this medication, including dyskinesia, hypotension, and cardiac arrhythmias, can sometimes be equally detrimental to quality of life\textsuperscript{8}. Moreover, Levodopa is less effective at treating cranial sensorimotor deficits, such as voice and swallowing deficits\textsuperscript{9}.

Exercise has also been shown to have beneficial effects for individuals with PD. Exercise is associated with a lower risk of developing Parkinson disease\textsuperscript{10}, and moderately intense exercise leads to increased levels of dopamine\textsuperscript{11}. Similarly, intensive vocalization exercise is effective at attenuating voice deficits in PD\textsuperscript{12}. In rat models of PD there are similar vocalization and motor deficits. In a 6-hydroxydopamine (6-OHDA) rat model of PD, exercise in the form of repetitive forelimb placing following a lesion was shown to rescue both the behavior and striatal dopamine levels. These findings suggest that repeated exposure to a sensorimotor task might have therapeutic effects\textsuperscript{13}. There is also evidence that intensive exercise is effective at rescuing vocalizations in a 6-OHDA rat model of PD. Intensive vocalization training following a unilateral lesion in the medial forebrain bundle led to a rescue of vocalization behaviors. However, in contrast to forelimb training, striatal dopamine levels were not rescued\textsuperscript{14}.

Taken together, these findings suggest that the underlying mechanisms leading to rescue of forelimb use may be different than those associated with improvements in vocalization. The primary aim of the present study was to determine whether rescuing striatal dopamine with intensive forelimb exercise would also lead to a rescue of vocalization behaviors, which one might expect if increased striatal dopamine levels were sufficient to rescue vocalizations. Given that the underlying mechanisms leading to vocalization rescue appear to be different than in the limb, our hypothesis was that vocalizations would not be improved with forelimb exercise. In order to examine the relationship between striatal dopamine levels and behavioral improvements, we quantified the amount of tyrosine hydroxylase (TH), an enzyme necessary for synthesis of dopamine, in the striatum of both lesioned and unlesioned hemispheres of trained and untrained animals. We hypothesized that there would be no difference in the concentration of TH between the two hemispheres in rats that received forelimb training, while rats that were untrained would have reduced levels of TH in the lesioned versus unlesioned hemisphere.

**Methods**

**Animals**

Four month-old male Long-Evans rats (Charles River) (n=16) weighing 300-350g were used in this experiment. In addition, ten month-old females (n=8) were used to sexually experience the males in order to elicit vocalizations. The rats were housed two per cage in standard polycarbonate cages with corncob bedding. Lights were maintained on a reverse 12:12h light;dark cycle. All of the training and testing
occurred in a dark room with red light illumination. The rats were handled for 12 days and sexually experienced for 8 days prior to baseline training. The rats were assigned to one of two groups: trained (n=8) and untrained (n=8). The University of Wisconsin Institutional Animal Care and Use Committee approved all procedures.

Parkinson disease model
The preferred limb was determined prior to surgery using a forelimb asymmetry test and the contralateral hemisphere was lesioned. Male rats received a unilateral intracranial infusion of the neurotoxin 6-OHDA into the medial forebrain bundle (see Ciucci et al. 2010 for details of the surgical procedure). This lesion results in a moderate to severe degeneration of dopamine neurons, Parkinson-like motor deficits in the contralateral limb as well as vocalization deficits.

Training
Rats in the training group performed forelimb exercise two days pre-lesion and three days post-lesion. Training consisted of a vibrissae-elicited forelimb placing task. To perform this task, the rats were first held mid-air, close to a table. Next, the rats’ whiskers were brushed, which elicited a forelimb movement as the rat reached for the table. The rats in the untrained group were handled instead of completing the training task.

Behavioral assessment: forelimb asymmetry and vocalization
Forelimb asymmetry was evaluated to behaviorally measure lesion severity and forelimb use improvement following training. The forelimb asymmetry test (cylinder test) consisted of placing each rat in an upright transparent cylindrical tube. While in the tube, the rat was allowed to explore with its forepaws. The amount of contacts that the rat made with each forelimb or both simultaneously was recorded until a total of 20 touches were reached. A forelimb asymmetry score was determined using the formula: (ipsilateral+1/2 both)/(ipsilateral+contralateral+both) * 100. The difference in forelimb use indicates lesion severity. A higher score indicates a more severe lesion.

Vocalizations were elicited using a female rat in estrous. The male rats were allowed to mount the female up to two times and then the female was removed. Vocalizations were recorded for 60 seconds after the female rat was removed using an ultrasonic microphone with a flat frequency response up to 150 kHz and a working frequency response range of 10-180 kHz (CM16, Avisoft, Germany). Acoustic analysis was performed offline.

Immunohistochemistry
Following testing, transcardial perfusions were performed using 4% paraformaldehyde to fix the tissue. The brains were then transferred into sodium azide for storage until they were sliced. Two days before slicing occurred, brains were placed into cutting cryoprotectant. The brains were sliced at 60μm using a freezing microtome. One out of every five wells in a 12 well tray was stained for the dopaminergic marker TH. Each slice was given its own well. The slices were washed four times (2x2 minutes and 2x15 minutes) in a wash buffer solution containing 0.01 M phosphate buffer saline (PBS), pH 7.4, and 0.3% Triton X-100. The slices were then soaked in a blocking buffer, composed of...
PBS, 0.3% Triton X-100, 2% Bovine Serum Albumin (BSA), and 20% normal goat serum (NGS), for 45 minutes. Sections were incubated for 15-24 hours at room temperature with constant agitation in the primary antibody solution (rabbit anti-TH; 1:2000 dilution), containing primary Ab, PBS, .3% Triton, 2% BSA, and 1% NGS. Sections were rinsed four times with PBS and 0.3% Triton and then soaked for three hours at room temperature in the secondary antibody solution, containing secondary Ab (anti-rabbit; 1:500 dilution), PBS, 0.3% Triton, and 2% BSA. The sections were washed 4 times in PBS and 0.3% Triton, then incubated in the ABC (Vector Laboratories) solution, composed of wash buffer, BSA, and drops of the reagents A and B, for one hour and washed in PBS for 20 minutes. The sections were reacted with 0.04% DAB (Acros Organics) and 0.01% hydrogen peroxide for 1.5-3.5 minutes until staining occurred. Rinsing in PBS terminated the reaction. Sections were mounted on gelatin-coated glass slides.

**Quantification of relative tyrosine hydroxylase amounts**

Sections were scanned into the computer using an Epson Perfection V500 scanner. After being stained with DAB the areas in the slices where the primary antibody bound appear a dark brown. The sections were analyzed for color density (darkness) (ImageJ, National Institutes of Health, Bethesda, MD) to quantify the amount of striatal dopamine loss (in percent loss) of the lesioned hemisphere relative to the unlesioned hemisphere. The concentration of TH staining in the lesioned hemisphere was subtracted from the unlesioned hemisphere. A percent loss was then determined by taking the total loss divided by the unlesioned hemisphere. This number was then multiplied by 100 to get a percentage. This indicated the level of dopamine sparing or recovery. A higher percent loss indicates a more severe lesion.

**Results**

**Behavior: forelimb asymmetry**

At day one post-lesion, both the trained and untrained groups had moderate lesions as determined by the cylinder test (Figure 1). A higher percent difference means that the rat tended to favor one limb over the other. The severity of the lesion-induced deficits for both the trained and untrained group was improved at day 13 post-lesion. The trained group had milder deficits in the cylinder test than the untrained group.

![Figure 1: At day 1 post-lesion both the trained and untrained groups of rats had moderately severe deficits as indicated by their forelimb asymmetry score. By day 13 post-lesion both groups improved. However, the trained group had more mild deficits than the untrained group.](image)

**Behavior: ultrasonic vocalization**

The average intensity of the elicited calls was similar between the trained and untrained group as noted in Figure 2. The maximum intensity was greater (louder) in the trained group versus the untrained group as seen in Figure 3.
Figure 2: The average intensity of vocalization was similar between the two groups.

Figure 3: The maximum intensity was greater (louder) in the trained group versus the untrained group.

**Neurochemical analysis**

Figure 4 shows the relationship between the trained and untrained group when comparing the percent loss of TH. A higher percent loss indicates greater depletion in the level of tyrosine hydroxylase in lesioned hemisphere. The group that received training had an average percent loss of 42.6%. The untrained group had an average percent loss of 34.2%.

Figure 4: The training group had a larger percent loss at 42.6%, while the untrained group had 34.2% loss of TH.

**Discussion**

The forelimb asymmetry scores indicate an improvement in use from day one post-lesion to day 13 post-lesion for both the trained and untrained groups. However, the trained group had a less severe lesion when compared to the untrained group by day 13, suggesting that forelimb training may have been effective. While average intensity of vocalizations was similar between the two groups, maximum intensity increased for the group that received training. This was interesting because the rats did not receive training for vocalizations. Unexpectedly, the trained and untrained groups had similar percent losses of TH; however the trained group had a higher percent loss.

Forelimb asymmetry improved for both the trained and untrained groups by day 13 post-lesion. However, the trained group had more mild deficits when compared to the untrained group. These results suggest that training may have been moderately effective. However, the differences were subtle and both groups improved over time, indicating that other factors may have contributed.

In addition to forelimb improvements there was also difference in the maximum intensity between the two groups. Animals that received training had a higher maximum intensity (louder) than the untrained animals. One possible explanation for this is that vocalizations were indirectly trained during the forelimb placing exercise. Even though vocalizations were not specifically trained, the rats may have been calling while they were completing the forelimb task. Given that targeted training of ultrasonic vocalizations
can lead to increases in intensity\textsuperscript{14}, if the trained rats were vocalizing more or louder during the task than untrained, this may have led to an increase in intensity. Vocalizations were recorded during the training, but this data has not yet been analyzed. An alternative explanation is that forelimb training resulted in increased dopamine levels which in turn led to increased intensity of vocalizations, though based on the immunohistochemistry (see below) this seems unlikely as the trained group did not appear to have rescued/spared dopamine levels.

The percent loss of TH was greater in the trained versus the untrained group. This was unexpected, though there are several possible explanations. It is possible that there were failed lesions in the untrained group that have not yet been taken out. This would make the untrained groups percentage less than if the rats with failed lesions were taken out. Also, the time of training may have exacerbated the dopamine loss in the trained group. Studies have shown that the timing and intensity of exercise can affect outcomes\textsuperscript{19}. Another possible explanation could be that rats with suspected failed lesions (based on forelimb asymmetry post-lesion) were excluded from behavioral analysis. For the behavioral analysis, the trained group had 3 rats and the untrained group had 4 rats, however, all but two of the animals in the untrained group were included in the immunohistochemical analysis. Lumafluor beads were added to the 6-OHDA in order to confirm the lesion site post-mortem. Once this data is analyzed, and rats with poor lesions based on placement are removed, the data may become clearer.

Anstrom et al. (2007) demonstrated that with intensive forelimb training, both forelimb behavior and striatal dopamine levels were rescued/spared. Based on the results that we collected we did not come to the same conclusion. Some animals in the training group did show increased levels of tyrosine hydroxylase, indicating a rescue of dopamine, however others did not. Methodological differences could account for why the results are not the same as those in Anstrom et al. Specifically, training in this study was immediately before and after the 6-OHDA lesion, which may have been a vulnerable time for the rats. In the Anstrom et al. study, a cannula was placed into the medial forebrain bundle two weeks before the 6-OHDA was infused. Training was still on days 1, 2, and 3 post-lesion, however acute stress related to the surgery may have exacerbated the striatal dopamine loss. Also, Anstrom et al. verified cannula placement in order to confirm the lesion site was accurate, which has not yet been done in this study. Once the lesion placement is verified, some animals may be excluded which could change the results.

Overall, trained animals showed improvements in forelimb placing and vocalizations, but not in the levels of striatal dopamine. In the future it would be interesting to look at the number of calls that were made in the 60 seconds of vocalization from the rats. Also, there were no statistical measures done on the data because of the small sample size. It would be beneficial to run this experiment again on a larger sample size.
Acknowledgments

I would like to thank my mentor Laura Grant for all of her help, my Principle Investigator, Dr. Michelle Ciucci, for allowing me to work in her lab, Breanna Hilby for letting me continue her study, Katie Blue for teaching me how to slice the brains, and Eunice Paul for helping me with the staining and analysis of the brains. I would also like to thank IBS-SRP and the McNair Scholars Program.

This research was supported by the:
- National Science Foundation (DBI-1063085)
- University of Wisconsin-Madison Graduate School

References


Perceived Stress as a Correlate of Cognitive Failures

Jessica L. Jorgenson, Psychology
Karen Petersen, Ph.D., Mentor
The College of St. Scholastica
School of Sciences, Department of Psychology

Abstract

When examining older cohorts or populations with psychiatric symptoms of distress, chronic stress has been known to have a number of adverse effects on the function and structure of the hippocampus resulting in decreased cognitive functioning and increased cognitive failures. The present study seeks to establish a similar relationship between perceived stress and cognitive failures among generally healthy and young participants. The Perceived Stress Scale and Cognitive Failure Questionnaire were administered to 144 undergraduate students at the College of Saint Scholastica. After controlling for sleep, caffeine consumption, and gender, perceived stress was associated with cognitive failures (F(4,124) = 7.87, p<.001). Based on this relationship, experimental research should be conducted to identify whether perceived stress is causing cognitive failures in young, healthy volunteers.

For a variety of researchers, stress has been an important topic of interest for quite some time. Stress plays a vital role in the biological functioning of our bodies. Acute stress can be beneficial during the fight or flight response (McEwen & Krahn, 1999), but can be more disastrous with chronic, prolonged stress. Not only does stress affect health through direct physiological pathways, it also activates physiological responses via the sympathetic nervous system and the hypothalamic-pituitary-adrenal cortical axis (Cohen, Kessler, & Gordon, 1995). Understanding stress more clearly and its effects on the body could promote more accurate and effective treatments to cope with stress (Lazarus, 1980).

However, researches are still finding it difficult to conceptualize stress (Segerstrom & Miller, 2004). Many studies simply define stress as events that a majority of people find stressful. This definition seems vague, incomplete, and misleading. Cohen, Kamarck, and Mermelstein (1983) postulated that the response to a stressful event is not predicted solely by the intensity or quality of the event. Rather, they explained that the appraised stress or emotion associated with an event is dependent on “personal and contextual factors as well.” For example, most people may classify the death of a relative as a stressful event. However, if the individual who lost the relative was not close to the deceased, they would not appraise the situation as stressful due to personal and contextual forces. Because stress does interact with personal factors, it may be difficult to ascertain reliable and valid physiological data. This is especially true when participants are appraising stressful events differently.

Due to the complications inherent in objectively measuring stress, the present study will address the concept as perceived...
and self-reported. Cohen and Williamson (1988) explain that the Perceived Stress Scale, which this research utilizes, measures the degree to which situations in an individual’s life are appraised as exceeding an individual’s ability to cope. Lazarus (1966, 1980) suggested that a feeling of stress will arise only if the individual appraises or perceives it as stressful. Stress as a perceived concept more accurately depicts the personal and contextual factors influencing the individual.

Clearly, perceptions of stressful instances vary from person to person. Complicating the research even further is the multifaceted demands stress places on the body from within the brain. There are two body systems activated by stress: the sympathetic nervous system (SNS) and the hypothalamic-pituitary-adrenal-cortex axis (HPA). The former is associated with stress preparing the body to overcome short-term emergencies or threats. The latter induces the anterior pituitary gland to release adrenocorticotropic hormone (ACTH), which further causes the adrenal cortex to secrete cortisol. A plethora of biological changes occur in the body as a result of cortisol including increased blood sugar, blood pressure, and down regulation of the immune system. These physiological changes lead to alterations in brain structure and function. Nerve cells in the brain begin to atrophy or are less excitable in the hippocampus. This region of the brain is important for spatial and verbal memory (McEwen, & Krahn, 1999). The changes in this area ultimately hinder the brain’s ability to keep track of information and locations.

The effects of chronic stress on the hippocampus, resulting in impairment and lapses in memory, contribute to the present study’s rationale for hypothesizing a positive correlation between stress and cognitive failures. Past research has established a relationship between psychiatric symptoms of distress and cognitive failures. Generally, the subjects of these past studies were diagnosed with depression or showed similar symptomatology (Reason, 1988). However, the present study seeks to discover whether or not a relationship between stress and cognitive failures can still exist in a healthy and young population.

Cognitive control uses relevant information from the past in order to execute future goals (Lorist, Boksem, & Ridderinkhof, 2005). There are two major types of failed action: planning failures and execution failures. Planning failures are the mistakes made because of misinformation, and execution failures are the mistakes made in carrying out a plan (Reason, 1988). Execution failures have the correct information to carry out a plan but make a mistake while implementing it. Cognitive failures are execution failures caused by a slip in memory or attention (Efklides & Sideridis, 2009). People are more likely to make cognitive failures when the task is highly automated, in familiar surroundings, or preoccupied by inner turmoil (Reason, 1988).

There are many different explanations as to why people have cognitive failures. One theory is the anterior cingulate cortex (ACC) detects if an adaptive control process must be activated in order to minimize the risk for error (Lorist, Boksem, & Ridderinkhof, 2005). The adaptive control process could be executed by such events as post-error slowing or long-term strategic adjustment. Extremely long periods of demanding
cognitive activity reduce the mesencephalic dopaminergic output to the ACC. This implies mental fatigue is the result of inadequate levels of dopaminergic transmitters to the ACC, causing the impaired performance in monitoring and performance adjustment. One way people tend to reduce strain on the ACC and decrease errors is by increasing response time on tasks.

Another cause of cognitive failures may be the coping strategies people employ (Matthews, Coyle, & Craig, 1990). During any task, including practiced ones, some degree of attentional investment must be used to perform it correctly (Reason, 1988). Under normal circumstances people hold in reserve part of their attentional investment in order to account for unexpected changes in the external environment and guard against cognitive failures. Individuals with higher cognitive errors have been reported to use coping strategies to suppress emotions from disrupting a task that uses a higher level of the limited cognitive capacity available. Those reporting a smaller amount of cognitive failures use more active, less cognitive resource draining coping strategies. Depression and high anxiety are known to raise cognitive failures scores. This can be explained because individuals with this diagnosis tend to have attention inflexibility. They spend a large amount of attentional resources ruminating on painful emotions only diverting away from these thoughts for the most disastrous of circumstances (Cheyne, Carriere, Solman, & Smilek, 2011).

Because individuals with psychiatric symptoms of distress are reporting higher levels of cognitive failures due to unsuccessful coping strategies, the present study proposes a correlation between cognitive failures and an important coping mechanism—perceived social support. Individuals deficient in perceived social support have reported higher cognitive failures than those who perceive their social support system as adequate (Dickinson, Potter, Hybels, McQuoid, & Steffens, 2011). Research has shown students lacking social support tend to have dysfunctional schemas for coping with the environment and utilize coping strategies that may limit cognitive capacity (Thorsteinsson & Brown, 2008). As previously mentioned, coping strategies are related to the amount of cognitive failures an individual reports.

While individuals who report inadequate levels of social support are utilizing coping strategies that may limit cognitive capacity, they also engage in more dysfunctional coping strategies. These behaviors include alcohol consumption, sedentary behavior, and either an increase or decrease in sleep (Thorsteinsson & Brown, 2008).

According to Carver (1989), sleep becomes a dysfunctional coping strategy when an individual attempts to “sleep the stress away.” However, sleep deprivation can have detrimental effects on cognition. Areas in the cognitive domain that have been affected include short-term memory, working memory, processing speed, and tasks of selective attention (Lim & Dinges, 2010).

While a lack of sleep can decrease cognitive function and increase cognitive errors, the way an individual creates a schema of their environment can also affect the number of cognitive failures experienced. People who use internal coding perceive the environment based on previous schemas—
on what they expect—and less on the current environment, increasing their cognitive failures. External coders make a new schema after verifying information with the environment and are less likely to have cognitive failures. Internal coding is also more likely to create self-perpetuating errors because they fail to change their schema even after making a mistake (Herndon, 2008).

Through years of research the academic community has accepted the idea that they are differences in brain structure and function among the genders, but what could this mean for cognitive failures? The research is mostly mixed and incomplete. Interestingly, females tend to report higher cognitive failure scores than males in naval populations. This could be caused by a generally higher strain level for females due to conflicting demands with work and family or an effort-reward imbalance (Bridger, Brasher, Dew, Sparshott, & Kilminster, 2010). However, another study explains males make more cognitive failures while driving than females do (Wickens, Toplak, Wiesenthal, 2008). The differences could be situational, but further research is needed.

All of the above literature outlines instances in which cognitive functioning is being negatively impacted. However, when attention is sustained, facilitated by caffeine, cognitive failures can decrease and cognitive functioning can increase (Nehlig, 2010). Caffeine has shown to reverse cognitive aging in older adults (Lorist, Snel, Mulder, & Kok, 1995.) The present study is interested in the effects of caffeine on a healthy and young population, if any.

The Current Study

As identified in this literature review, perceived stress is one way to conceptualize stress. Chronic stress can be detrimental to our health. In terms of the present study, changes in the hippocampus are of particular importance. These changes in the hippocampus can lead to increased cognitive failures as past research has shown (Reason, 1988). The present study seeks to find similar results among a college population without a single universal stressor such as an exam. The lack of a universal stressor would identify whether or not students who generally report high levels of perceived stress also report high levels of cognitive failures. In addition to investigating the relationship between perceived stress and cognitive failure, this study seeks to analyze a hierarchical relationship between cognitive failures and an assortment of covariates.

Hypotheses

College students are likely to encounter a variety of perceived stressors throughout their academic career. These stressors can have negative psychological and biological effects and may be linked to increased cognitive failures. However, some students tend to report lower levels of perceived stress and cognitive failures than their peers because of alternative coping schemas. Predicting which students are more likely to experience cognitive failures may help determine the students who would most benefit from cognitive coping strategy training. In relation to the preceding statements, the following hypotheses were analyzed:
1.) There will be a positive correlation between scores on the Perceived Stress Scale and the Cognitive Failures Questionnaire. Students who report higher levels of perceived stress also report higher levels of cognitive failures.

2.) Several covariates will be associated with cognitive failures:
   a.) There will be a correlation between gender and cognitive failures. Women will report higher levels of cognitive failures.
   b.) A negative correlation between average hours of sleep per night and cognitive failure scores will exist. Those reporting higher levels of cognitive failures, will be reporting a lower average amount of sleep per night.
   c.) There will be a negative correlation between average daily caffeine consumption and cognitive failure scores. Those who report a higher caffeine intake will report lower cognitive failure scores.
   d.) There will be a correlation between perceived social support and cognitive failure scores. Those who do not perceive an adequate social support system will report higher cognitive failure scores.

3.) Perceived stress will continue to have a predictive relationship with cognitive failures even after accounting for covariates that were associated with cognitive failures in univariate analyses.

**Method**

**Design and Procedure**

Participants consisted of self-selected undergraduates of The Saint Scholastica. Non-traditional students were not excluded from the study. Each student read and gave consent to an informed consent page before they proceeded to the online survey. The Saint Scholastica Department Review Board granted the present study ethical approval. The students responded to in-class, verbal recruitment as well as online recruitment via the student community announcements. Participants were given the opportunity to read about the hypotheses of the study after they finished the questionnaire. However, students were not told about their individual results.

**Measures**

The Cognitive Failures Questionnaire (CFQ) was utilized to measure the frequency of cognitive failures. The CFQ is a twenty-five item questionnaire that asks about general mistakes made in the past six months. Questions such as “Do you read something and find you haven't been thinking about it and must read it again?” and “Do you lose your temper and regret it?” were asked. There were five possible answers for each question consisting of “Very often”, “Quite often”, “Occasionally”, “Very rarely”, and “Never”. This questionnaire can be broken down into the following categories: imperfections in memory, distractions due to inattention, blunders due to distractions, and failing to remember names (Herndon, 2008). The test-retest reliability for the CFQ is high at .82 after 21 weeks and .80 after 65 weeks (Bridger et al, 2010). The Cognitive Failure Questionnaire has ecological validity. For example, those who have a higher cognitive failure score also have higher incidents of car accidents or other mishaps due to cognition failures (Efklides & Sideridis, 2009).

Stress was measured using the Perceived Stress Scale-10 (PSS-10) which is used to measure the psychological construct.
perceived stress (Cohen, Kamarck & Mermelstein, 1983). The PSS-10 is a ten question survey asking about the feelings and thoughts of the individual within a one month span. For example, “In the last month, how often have you been upset because of something that happened unexpectedly?” and “In the last month, how often have you been able to control irritations in your life?” These questions are designed to measure the test taker's perceived uncontrollability of life, actual quantification of uncontrollability in life, and the overloading of life (Roberti, Harrington, & Storch, 2006). The PSS has been found to be a reliable and valid measurement for perceived stress in college students as well as other populations. Test-retest reliability for the PSS-10 scale has been found to vary from .85 after two days to .55 after six weeks (Cohen, Kamarck & Mermelstein, 1983). The coefficient alpha reliability for the PSS-10 is .84 to .86.

Results

The present study had 144 participants, 121 were female (84%) and 23 were male (16%). A significant number of participants are between the ages of 18-22 (78.3%). Traditional students accounted for 84% of the data. A majority of the participants identified as Caucasian (91.8%). Eight students did not attempt any of the questions and were excluded immediately. Additionally, nine students were later excluded from the final analysis because of a failure to answer every question of both measures.

Hypothesis 1

Past research has shown a relationship between cognitive failures and stress in the elderly and populations exhibiting psychiatric symptoms of distress. A Pearson correlation was calculated to analyze a relationship between cognitive failures and stress as reported by these young and healthy participants. A moderate positive correlation was found ($r(127) = .396, p<.01$), establishing a significant relationship between stress and cognitive failures. Those who indicate higher levels of cognitive failures tend to indicate more perceived stress. Figure 1 illustrates the relationship between stress and cognitive failures.
Hypothesis 2

Table 1 summarizes results of the univariate analyses between covariates and cognitive failures. Females reported more cognitive failures than men ($r_{pb}(132) = -.187, p<.05$), less sleep was associated with more cognitive failures ($r(132) = -.214, p<.05$), and those who consume more caffeine report fewer cognitive failures ($r_{pb}(132) = -.219, p<.05$). There was no relationship between cognitive failures and perceived social support ($r_{pb}(132) = -.123, p>.05$).

Table 1
Summary of Correlations of Cognitive Failure

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Correlation</th>
<th>$p$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>$r_{pb}(132) = -.187$</td>
<td>.032</td>
</tr>
<tr>
<td>Caffeine Intake</td>
<td>$r(132) = -.219$</td>
<td>.011</td>
</tr>
<tr>
<td>Sleep</td>
<td>$r(132) = -.214$</td>
<td>.014</td>
</tr>
<tr>
<td>Social Support</td>
<td>$r_{pb}(132) = -.123$</td>
<td>.159</td>
</tr>
<tr>
<td>Perceived Stress</td>
<td>$r(127) = .396$</td>
<td>&lt;.001</td>
</tr>
</tbody>
</table>

Hypothesis 3

A hierarchical regression was utilized to account for the significant variables mentioned in hypothesis 2: gender, sleep, and caffeine consumption. After controlling for those variables, a strong relationship was found between perceived stress and cognitive failures ($F(4,124) = 7.87, p<.001$). Table 2 includes information about the regression.
Discussion

We hypothesized that there would be a positive correlation between perceived stress and cognitive failures. Consistent with the literature, this relationship was statistically significant in this young and healthy population. Past studies conducted with young and healthy participants usually entailed a pre-test post-test design with a universal stressor such as an exam (Kane, 1987) or homesickness in freshmen international students (Fisher & Hood, 1987). The lack of a universal stressor in this particular study could suggest a correlation between perceived stress and cognitive failure that persists within the student population regardless of the presence of a specific stressor.

The relationship between cognitive failures and a number of covariates such as gender, sleep, and caffeine consumption yielded statistically significant results. We found that women reported more cognitive failures than men; the literature has been inconsistent with regard to gender and cognitive failures (Bridger, Brasher, Dew, Sparshott, & Kilminster, 2010; Wickens, Toplak, Wiesenthal, 2008). Those who reported more sleep per night tended to report lower cognitive failures which aligns with the current research (Lim & Dungen, 2010). Another statistically significant inverse relationship existed between cognitive failures and caffeine consumption; this relationship has been demonstrated in older populations (Lorist, Snel, Mulder, & Kok, 1995).

Surprisingly, the present research did not find a statistically significant negative correlation between perceived social support and cognitive failures as hypothesized. This finding is inconsistent with the literature of older populations (Dickinson, Potter, Hybels, McQuoid, & Steffens, 2011). However, the data suggests the results were trending in this direction ($r_{132} = -.123, p=.159$). It is important to note that the present study did not use a preexisting measure to address perceived social support. The question, “Do you think you have a good social support system?” was utilized. Results may have been

<table>
<thead>
<tr>
<th>Step and Variable</th>
<th>β</th>
<th>SE</th>
<th>ΔR²</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td>.167</td>
<td>.130</td>
<td>.087</td>
<td>.055</td>
</tr>
<tr>
<td>Caffeine Intake</td>
<td>.137</td>
<td>.043</td>
<td>.132</td>
<td>.120</td>
</tr>
<tr>
<td>Sleep Habits</td>
<td>-.140</td>
<td>.043</td>
<td>.115</td>
<td></td>
</tr>
<tr>
<td>Step 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td>.080</td>
<td>.126</td>
<td>.115</td>
<td>.340</td>
</tr>
<tr>
<td>Caffeine Intake</td>
<td>.124</td>
<td>.040</td>
<td>.124</td>
<td>.146</td>
</tr>
<tr>
<td>Sleep habits</td>
<td>-.115</td>
<td>.040</td>
<td>.127</td>
<td></td>
</tr>
<tr>
<td>Perceived Stress</td>
<td>.352</td>
<td>.127</td>
<td></td>
<td>&lt;.001</td>
</tr>
</tbody>
</table>
significant if a valid and reliable measure was employed.

The final hypothesis suggested that a statistically significant relationship between perceived stress and cognitive failure would persist after controlling for variables that were significant in univariate analyses. Statistically significant results suggest that the relationship between perceived stress and cognitive failure is quite strong even after controlling for gender, caffeine consumption, and sleeping habits.

It is clear that a strong relationship exists between cognitive failure and perceived stress. However, because this is a correlational study, we cannot identify a causal relationship. It is possible that chronic stress impacts individuals even at a young age. Statistically significant relationships typically found in older adults and those exhibiting psychiatric symptoms of distress are being found between perceived stress and cognitive failure in comparatively young populations. Alterations in brain structure and function result from chronic stress. Atrophy of nerve cells within the hippocampus is most worrisome within this population because the hippocampus is generally not fully developed until early adulthood (McEwen, & Krahn, 1999). In this young population, atrophy of nerve cells in the hippocampus may be occurring at a time when the hippocampus is supposed to be developing. In animal experiments, early stress lead to the production of enduring morphological changes in the hippocampus and other brain structures (McEwen, 2000). Are these same changes occurring within our own youth?

The current study has several strengths. This study had a large sample size of 144 participants, an even distribution of class status freshmen-senior was achieved, and the present study was able to identify a relationship between stress and cognitive failures even after accounting for several important covariates. Finally, the CFQ and PSS-10 are both very reliable and valid measures that are used frequently in academic research (Bridger et al, 2010; Cohen, Kamarck & Mermelstein, 1983; Efklides & Sideridis, 2009).

The study was limited by a few factors mentioned above such as an inadequate measure for perceived social support. The large female population (84%) limits the generality of the results. Further limitation may lie within the measures and design of the study. Within any questionnaire, self-report issues arise. For example, the CFQ questionnaire is subjectively affected by the participant’s memory of their cognitive failures rather than actual frequency of cognitive failures. Within the measure itself, frequent memory failure has been connected to depression or poor self-esteem (Rabbitt, 1990). Those with a high CFQ could have a general pessimistic view of life causing their CFQ score to increase artificially rather than from an actual high frequency of cognitive failures (van Doorn, Lang, & Weijters, 2010). Similarly, if individuals have a general dissatisfaction of life this may cause the PSS-10 score to be artificially high (Cohen and Williamson, 1988).

Future research should focus on better understanding this relationship through experimental designs that might identify directionality or bi-directional relationship between perceived stress and cognitive...
failure. Because of the many statistically significant correlations, there are a number of future research directions that could be aimed at deciphering the relationships between sleep, social support, caffeine consumption, gender, perceived stress, cognitive failure, and others. For example, future research on the relationship between caffeine consumption and cognitive failures could utilize a longitudinal design to address different levels of caffeine consumption and long term effects on cognitive functioning, more specifically, memory. The research goal should entail determining causal relationships. Finally, future research should be employed to identify the best methods to attenuate any health declines related to these variables possibly saving resources and diminishing medical expenses.
References


*The College of St. Scholastica | McNair Scholars Program*
Section, 96453-467. doi:10.1016/0168-5597(95)00069-5

Author Note

Jessica Jorgenson, Psychological Sciences student, The College of St. Scholastica of Duluth, Minnesota.

This research was supported, in part, by an allowance provided by the McNair Scholars Program at The College of St. Scholastica.

Any correspondence concerning this article should be directed to Jessica Jorgenson, Box #2549, College of Saint Scholastica, 1200 Kenwood Avenue, Duluth, MN 55792. E-mail: jjorgens@css.edu
Are Native Americans Conquered?

Matthew H Northrup, History
Hong-Ming Liang, Ph.D., Mentor
The College of St. Scholastica
School of Arts & Letters, Department of History

Abstract

In the 21st century is it appropriate to classify the indigenous tribes within the United States as conquered? This question arose from recently watching the 1992 movie Thunderheart. In this movie a F.B.I agent is tasked, due to his “Indian heritage”, to investigate some crimes on an Indian reservation in the Dakotas. During his first exposure to reservation life the main character is told this by another F.B.I. agent “I know more about the law and the history out here than the people themselves. Let me tell you, I feel for them. They’re a proud people. But they’re also a conquered people. That means their future is dictated by the nation that conquered them. Rightly or wrongly, that’s the way it works, down through history”. In this paper I am going to answer the conquered question by examining several areas including; past and present policies and procedures of the federal government, Supreme Court cases involving indigenous tribes and the revitalization of the language and culture of the indigenous population (IP).

Introduction

The policies of the federal government in the past would support the argument that indeed the indigenous tribes of the United States are conquered. These policies, which can be viewed at as genocide and forced assimilation, are now looked back upon in disgrace. Current policies towards the tribes of the United States show a noticeable difference in the treatment and acceptance of the indigenous people. In the past such policies were meant to convert the “noble savage” into American society. Now these policies are meant to maintain the tribe’s individual sovereignty and culture within the United States.

Methodology

Using the quantitative method I searched the CSS library databases including SOLAR, ScholastiCAT, and ASP to find ideas for information that included previous research, historical text and documents. I also used the Ruth A. Myers Library and Ojibwe Archives on the Fond du Lac Tribal and Community College campus to help focus on areas mentioned. The limited time for this study focused me to use this method and also to narrow my discussion to the Anishinaabeg people when it came to the contemporary court cases and cultural revitalization information. Complexity and differentiation of the indigenous tribes of the US is also generalized for ease of reading but it shows that one word cannot properly describe all of them.

Literature Review

The support for and against the use of the term conquered when describing the IP is lengthy and numerous as the tribes on the
continent so for this paper the focus will be narrow. Support for the claim of conquered will be shown in population decline, the existence of extinct tribes, and negative policies and court cases against the IP. Recent court cases, governmental policies, and the growth of tribal colleges and universities, that emphasize cultural and language revitalization of the IP, show that the IP do not fall under the label of conquered.

There are many books that deal with complex history of the IP of North America (NA) and for this paper I choose the authors Thornton, Deloria, Peacock, Spicer, Grenke, Warren, and Pevar. The books these authors wrote provide clear and concise facts for both sides of the argument presented. The facts that support the claim that the IP of NA are indeed conquered are archaic as the term itself but are the basis for the counter argument. This counter argument includes severe population decline, previous federal policies, and court cases. The year 1492 will be used as the date for determining IP of NA as described by Thornton, in chapter two of American Indian Holocaust and Survival, for three reasons: (1) it has been recognized as the year of the first important discovery of the Western Hemisphere by non-Indians; (2) no evidence exists that the earlier Scandinavian or other possible European - Native American contacts significantly impacted either hemisphere: and (3) there were important demographic effects for American Indians, and possible also for European and African populations, almost immediately after 1492 (Thornton 15).

The population of the IP of NA prior to 1492 has been debated constantly since one of the first population estimates made. The first population estimate (PE) was conducted by the artist George Catlin, who lived amongst American Indian tribes in the 1830s, for which he speculated the number to be around sixteen million. Determining the native population at the year 1492 is important for it sets a number which allows for a better understand of the impact of European contact and how the term conquered may still apply. During the twentieth-century scholars have come up with a wide range of figures for the IP for the year 1492 and that could be partially attributed to the methodology of estimating a population. This methodology and the break-down of western hemisphere and North America population numbers will be examined next to finalize an acceptable population number for the year 1492 (Thornton16 & 17).

During the twentieth-century population estimates generally, but not always, followed a methodology that included: the scope of the estimates; the data on which the estimates are based; the techniques of data evaluation; and the techniques applied to the data to derive estimates. The geographical scope is one that will provide a widest range of population numbers due to the area and/or people being studied. When deciding on a western hemisphere number some PE have come from an overall area estimate or one made from counting the population number from regions within the hemisphere. The PE of North America in turn may be one that made up from the hemispheric estimate or it may be made up of smaller area estimates similar to the larger hemispheric estimates combinations (Thornton 18).

The data that is used to come up with a PE is varied as well and comes from ethno
historical sources, ecological evidence, social structure, and archaeological, physical anthropological and demographic data. The figures and estimates reported by early European explorers along with early church, government, and other censuses make up the ethno historical source for PE. Two problems with this method of data use is accuracy of the sources and how only a portion of the debated population actually represents the population as a whole (Thornton 18-19).

Ecological evidence is one of the important uses of PE. These types of estimates are primarily made up from what is commonly referred to as “carrying capacity”. The carrying capacity is determined by how many people the land can support along with the given level of technology at the time. This type of data collection is open to doubt again due to the ever changing environment and technology along with the idea that simply because a large population can be supported doesn’t mean it happened (Thornton 19).

Another inaccurate way of data collection to formulate a PE is the use of the social structures of the IP themselves. By using the social structures a PE can be surmised to show the population size by using the political organization and degree of cultural evolution of said IP. Thornton calls this “speculative” because the PE was based on inaccurate reports of how social structures were associated to population size (Thornton 19).

The excavations of IP sites and mounds along with settlement and agriculture patterns make up archaeological data collection in the formation of a PE. Again questions are raised with this type of data collection from the interpretation, sampling, and dating of the collected information (Thornton 19).

Physical anthropological data uses skeletal remains in order to determine a PE and the remains come from excavated burial grounds of the studied IP. In order for this type of data to be accurate additional information is required including, knowledge of the completeness of the sample; information about the archaeological associations of the skeletons; a determination of the lengths of time the sample represents; and an adequate assessment of sex and age at death (Thornton 19).

Using demographic data from mortality rates due to epidemics to form a PE seems legitimate enough seeing there is documentation of small pox epidemics and how it impacted the IP with regards to its overall numbers. The problem with this using this data is variables including general health and environmental conditions amongst the various groups of the IP (Thornton 19).

The evaluation of data is important and several techniques have developed for scholars to help establish accuracy. Five of them are cross-checking, temporal checking, event checking, credibility checking, and demography checking. With cross-checking a source of information is evaluated against another source of information. This comparison is helpful because accepted facts serve as a base for the evaluation allowing for easier acceptance of new data (Thornton 20).

When using temporal checking, data from two or more points in time are compared to
see if a conclusion can be made out of the figures in the data. With event checking the population being studied is compared against known historical events. This type of data checking is not used by most scholars due to the unknown variables that may occur (Thornton 20).

Credibility checking, similar to cross-checking, examines the credibility of the evidence and the means it was collected by checking additional information of the same type. For example, the difference in the numbers of the IP claimed by Europeans in early contact. Some of these population numbers are clearly exaggerated while the other under reported. When you would compare the two against each other you see the reports are unreliable. Thornton says with regards to this idea of data checking: “Credibility is not always dependent upon intent; one must also look at the methodological assumptions, sources, and procedures employed to obtain data” (Thornton 20).

Demography checking is most desired when evaluating data due to the work of past demographers; who have generated the knowledge about populations and the techniques to obtain such information. This has given the researcher the ability to better understand the many characteristics of population structure along with the variables of population change. Problems have been recognized and understood in the collection of this type of information; for example a census where incompleteness, bias and general errors may occur (Thornton 20).

The final step in the methodology of determining a PE are the techniques used when applying the data collected in a production of a number. The easiest of these techniques is what Thornton describes as the ethno historical method in which existing population numbers are used to check the data and personal judgment plays into acceptance of those numbers and data. Projective techniques are used when not using existing estimates for the IP in the area to calculate a PE. These include subpopulation, subareal, ecological, carrying-capacity, and depopulation projections. For subpopulation projections the number of a subpopulation of a larger group is multiplied to represent the overall number. This type of PE is done by establishing a ratio of total population to that of the subpopulation but accuracy of the ratio may be questioned (Thornton 21).

For subareal projections the known population of a subarea is used to determine the population of a larger or different subarea. This is again done by multiplying a ratio that was calculated from that data of the known subarea. Just like the use of the subpopulation projection the subareal ratio is assumed and can be called into question (Thornton 21).

Using indirect information as a method, like the known number of villagers or houses in a village, is called ecological projection. To do this the average village or house size is figured out and that is used to calculate the number of villages or houses in an area. Estimation may also be made based on the pattern of sizes for comparison that say several small villages and house would make up a large village or house. Acceptable ratio accuracy is once again assumed with this method (Thornton 21).

Carrying-capacity projection (CCP) has been used to estimate the IP of NA since the
1950’s and most recently as 1983. CCP is based on the principle that certain environments along with known levels of technology at a given point can be used to calculate how many people that can be supported by a studied ecological area. With this quantity a population density number is calculated and in turn this is multiplied by the total area for the PE. Problems with this projection are once again the unknown variables (Thornton 21-22).

Depopulation projection is the last method that may be used in determining early PE. This is done by using known rates of IP depopulation over a certain period of time and working backwards to another known depopulation rate to determine a ratio to calculate a PE for an earlier unknown time. Two additional depopulation projections include the epidemiological and mathematical approach. With the epidemiological projection the PE is determined from using known epidemics and their mortality rates against a contemporary IP. When applied this way an earlier PE may be made. Additional cause of depopulating may be used when determining a PE in this manner and these include warfare, genocide and natural catastrophe. The mathematical method makes projections by using lines or curves fitted against known PE which are then followed back in time. Assumptions are made again with the ratio in the epidemiological projection and in the mathematical approach population given a line to follow may not do so (Thornton 22).

During the twentieth-century PE of the IP living in the Western Hemisphere at the time of European contact had a wide range. In 1939 anthropologist Alfred Kroeber put forth an estimate of 8.4 million by estimating the populations of hemisphere subareas then totaling them for his overall figures. Anthropologist Henry Dobyns in 1966 gave a PE of 112.5 million by using the same subareal process as Kroeber but used a different methodology to determine his initial subarea populations (Thornton 22).

Using earlier estimates for tribes and regions in Central and North America Kroeber came up with his PE after amalgamating this early data with additional data from his own carrying capacity theory. Dobyns used the depopulation method to determine his PE. By examining population histories of the American Indian after European contact Dobyns came up with depopulation ratios of 1/20 and 1/25. Then by taking the known nadir populations he simply multiplied those numbers by 20 or 25. The main argument against Dobyns’ PE is that the depopulation method does not take into account that some American Indian populations did not recover. To counter this argument Thornton quotes Dobyns’ response to this question from Dobyns’ book Estimating Aboriginal American Population: An Appraisal of Techniques with a New Hemisphere Estimate (1966). “It may be possible to use a ratio to approximate the aboriginal magnitude of such extinct groups based on the number of survivors about 130 years after initial contact. There is some evidence that this was frequently the time native American populations required to reach nadir and begin to recover—-at least it was so among the Central Mexican and California Indians” (Thornton 22-23).

In 1976 geographer William Denevan made a PE of the IP of the Western Hemisphere at
the time of European contact of 57.3 million. Denevan came up with this number after studying the estimates of several other scholars, including Kroeber and Dobyns, along with inserting his own impressions of the data. Even with a self-acknowledged 25 percent error Denevan’s numbers really range from 43 to 72 million. The PE of 57.3 million represents the midpoint of the extremes of Kroeber and Dobyns and in the view Thornton the upward estimate of 72 million is the most realistic total for the population of the Western Hemisphere in 1492. These variations of PE do indeed show how differences in data collection and methodology may impact on population totals (Thornton 24-25).

Looking at how North American PEs were calculated we can see that due to the subareal methodology of Kroeber and Dobyns they are the extremes PEs for North America. Kroeber came up with a PE of 900,000 north of the Rio Grande. Dobyns had an original PE of 12.25 million but was changed to 18 million living north of Mesoamerica. Other twentieth-century scholars PEs fall between those extremes put forth by Kroeber and Dobyns with most falling around the one million mark (Thornton 25).

This one million mark for population may have been influenced by the Smithsonian Institution anthropologist James Mooney, who in 1910 came up with the first scholarly PE of the IP of North America. Mooney came up with the PE by using primary sources that included published reports and notes of European explorers and secondary sources of accepted estimates made by his peers. With this data Mooney ascertained individual tribal population sizes from which he could estimate regional population figures for periods marked by initial extensive European contact. The dates of contacts that make up Mooney’s PE range between the 1600-1845 (Thornton 26).

For the first half of the twentieth century Mooney’s figures were accepted by scholars as they came up with the one million numbers for themselves. It was only during the latter half of the twentieth century did Mooney’s PE come under criticism but that criticism was unfair due to the nature of the numbers. Mooney’s PE was never to be used to judge population sizes but to be used to better understand periods of initial extensive European contact (Thornton 27).

After going through all of the different PEs submitted over the years Thornton has come up with his own PE for the IP of North America for the year 1492. Since Mooney’s estimate does not factor in early population reductions after European arrival his PE of 1 million is too low. Dobyn’s PE of 9.8 to 12.5 million can be called into question as well due to the different nadir numbers used. The PE that Dobyns put forth came from the higher nadir population and ratios and his numbers show it. What Thornton did was take the lower of the two (nadir and ratio) and formulated that at 1492 the population of the IP North America to be seven plus million (Thornton 31-32).

Now that a PE has been established for North America we can now examine the impact that European contact had on the IP overall numbers. These numbers would support the claim that the IP of North America was indeed conquered. The formula to help determine the decline of the IP after contact is written as such, PT2 = PT1 + (B-D) + (I-E). Where PT2 is population
size at time two, PT1 is population size at time one, B is births, D is deaths, I is immigrants, and E is emigrants. In the case of the IP of North America the population change was the result of more deaths than births, instead of more emigrants vs. immigrants, which is called natural increases or decreases (Thornton 43).

From 1492 till 1900 the IP of North America declined from 5+ million to about 250,000. This decline was attributed to the higher death rates and lower birth rates but the primary importance was the outpacing of birth rates by death rates. The factors that played into this population decline included; disease, warfare and genocide, removal and relocation and destruction of IP way of life. These factors are next examined to show how mortality rates increased for the IP during this 400 year period (Thornton 43-44).

The impact that diseases from Europe and Africa had on the IP was tremendous. The list of new pathogens that impacted the IP include: smallpox, measles, bubonic plague, cholera, typhoid, pleurisy, scarlet fever, diphtheria, mumps, tuberculosis, whooping cough, dysentery, syphilis, gonorrhea, malaria, yellow fever and alcoholism. From 1520 to 1900, 93 major epidemics and pandemics of the previously mentioned pathogens tore through the IP of North America on average intervals of every four years and two months. The main problem with these infections is they didn’t just come through and kill a lot of people and disappear; these pathogens arrived, spread and killed over and over again (Thornton 44-45).

Small pox was the greatest killer of the IP early on and in some cases mortality rates were as high as ninety percent and other rates, entire populations died. One smallpox epidemic along the Connecticut River during 1633-34, which was reported by Governor William Bradford of the Plymouth Plantation, ninety-five percent of the IP were killed (Calloway 48). Diseases introduced to the IP wreaked havoc upon their population for several reasons. First these pathogens found within this introduced population new areas to grow, spread and kill. Secondly due to the lack of defenses or immunity these pathogens could afflict the entire tribe at once thus reducing their numbers quickly over a short period of time (Thornton 46).

Even when a vaccination for small pox was discovered in the eighteenth-century and used for most of the nineteenth century in the United States; it was only during the last half of the nineteenth century were American Indians vaccinated on a wide scale. That is not to say some of the IP were vaccinated earlier. President Thomas Jefferson in 1801 vaccinated the first Indians of North America when a group visited the District of Columbia. Two years later Jefferson gave instructions to explorers Meriwether Lewis and William Clark to vaccinate the Indians they met while traveling westward. This effort was met with little success due to the limited amount of the vaccine that Lewis and Clark had access to and could carry (Thornton 82, 100).

There were other epidemics that impacted the IP of North America besides small pox. There were at least six eighteenth-century epidemics of measles, three of influenza, two of typhus, diphtheria, scarlet fever, along with one known outbreak of the plague, and typhoid. Due to the nature of
colonization and trading, different tribes were impacted by different diseases. Measles, dysentery, and cholera epidemics infected, with high mortality rates, the IP of Texas. Sexually transmitted diseases were introduced in the Pacific Northwest by sailors and traders during the 1780’s and large quantities of alcohol were introduced to the IP along the Columbia River by Russian traders. The IP of California had to deal with epidemics of spotted fever, syphilis, malaria, and measles (Thornton 82-82). When infections crept into the villages of the Anishanaabeg of Lake Superior area the tribes had special methods of dealing with the pathogens. When a person or persons fell ill a separate lodge was made and set apart from the village for their use only. A medicine man was the only person to have contact with the sick and it was his responsibility to tend and cure the infected. The clothes and shelter were burned if the sick person died because of a virulent disease (Warren 100-101).

There have been instances where Europeans intentionally spread these pathogens amongst the IP of North America. These types of measures were encouraged by settlers and the best documented case is the British military conducting germ warfare against the Delaware Indians around Ft. Pitt. These British officers would give handkerchiefs and blankets infected with smallpox to the IP in order to suppress a military alliance that threatened the British land holdings in the 1760’s (Grenke 137).

Warfare and genocide were other factors in population decline for native people. Although not as a major cause of population decline as disease exposure, warfare and genocide did push some tribes to the brink and other tribes to extinction. There was of course warfare that had detrimental effects on population amongst the IP prior to the arrival of Europeans but that changed after first contact. Warfare became more widespread and severe when new types of alliances were forged between Europeans and the tribes of North America. It is difficult to assess how much of the population was reduced from warfare after the arrival of the Europeans but it is safe to say the losses for the IP were much higher than that of the non-native (Thornton 47-48).

Thornton on page 48 uses this U.S. Bureau of the Census report written in 1894 as a base to formulate a guess at how many of the IP died in warfare since 1775:

It has been estimated that since 1775 more than 5,000 white men, women, and children have been killed in individual affairs with Indians, and more than 8,500 Indians. History, in general, notes but few of these combats. The Indian wars under the government of the United States have been more than 40 in number. They have cost the lives of about 19,000 white men, women, and children, including those killed in individual combats, and the lives of about 30,000 Indians. The actual number of killed and wounded Indians must be very much greater than the number given, as they conceal, where possible, their actual loss in battle, and carry their killed and wounded off and secrete them. The number given above is of those found by the whites. Fifty percent additional would be a safe estimate to add to the numbers given.

Adding the 50 percent to the number proposed by the Census and the 8,500
brings the total number killed to 53,500 killed in wars between 1775 and 1890. Those killed in wars and individual affairs before 1775 may even double that estimate (Thornton 48-49).

One of the tribes to become extinct in the United States was the Yana. The reason this case is brought up in this paper because the extinction was actually recorded by anthropologists; thus this scientific evidence supports the use of conquered. The Yana was a small tribe, living near present day Redding California, which made first contact with non-natives in 1821. Four subdivisions, or tribelets, made up the Yana and they were the Northern, Central, Southern and Yahi. Some estimates put the size of the Yana population at 2,000 in 1821 with some being as high as 3,000. Due to epidemics, forced removal and genocide the Yana were destroyed practically overnight. Captain John Fremont first started the genocide in 1846 when he massacred a peaceful gathering of Yana Indians along the Sacramento River. Over the next two decades the Yana suffered under a series of massacres which culminated in the 1867 Dog Creek massacre in which 45 Yana were killed. A quote from that time shows the dire situation the Yana were in, “bodies lay on the ground as there were not enough Yana left to bury them” (Thornton 109-110).

Additional massacres of the Yana continued and in one particular case in 1868 33 Yahi Yana were murdered and scalped by four whites at Three Knolls near Mill Creek. The four were led by Norman Kingsley to which he explained afterwards he had to switch from using his .56-caliber Spencer rifle to a .38-caliber Smith and Wesson revolver because the rifle “tore them up so bad, particularly the babies” (Thornton 110).

The final massacre of Yana Indians occurred in 1870 when 16 were killed for suspicion of killing a cow. One of those killed was an eight year old boy who had survived the Three Knolls Massacre. After this massacre the remaining Yana slipped into the woods surviving on hunting, fishing and gathering until their numbers dwindled to just five. In 1908 a surveying crew came across a small village with five disheveled and starving Yana who upon seeing the white men immediately ran off. Due to the callous nature of the crew they destroyed what little the Yana had in that village which caused four of the five to eventually die of starvation and exposure. The final Yana lived by himself on former Yana lands until he was caught in August of 1911. This final Yana was taken to the Museum of the University of California by Professor Alfred Kroeber and given the name Ishi. Ishi lived under the charge of Professor Kroeber for the next four and a half years dying on March 25, 1916. The last full blooded member of his tribe, Ishi had escaped massacre after massacre to only have to live the remainder of his life with the race that perpetrated the genocide.(Thornton 111-12). This evidence of extinction weighs heavily in support of the term conquered, at least for this tribe.

The population rebound of the IP of North America since reaching nadir in 1900 defeats the reduced population argument that the IP are conquered. From the low of 250,000 in 1900 (Thornton 43) to its recorded population of 2,932,248 as collected by the 2010 census (census.gov) this increase provides the support that IP are not conquered. The IP of North America
has survived epidemics, warfare, and genocide to increase their numbers from nadir to almost three million today. Even though there has been growth in the IP, this number still less than half of the population that lived in North America prior to 1492 (Thornton 32). Yet between the years 2000 and 2010 the IP of North America had a population growth rate of 18.4% (census.gov) which means this population growth it is counter to the conquered term on the population argument.

In the past there have been many policies on the federal level that dealt with the IP of North America but two of these policies stand out as having a large impact on the IP. These are the Indian Removal Act of 1830 and the General Allotment Act of 1887. Andrew Jackson in 1828 wanted new policies regarding Indians and pushed for the passage of the Indian Removal Act (IRA) of 1830. This Act’s, which became dominate federal Indian policy of the nineteenth century, main purpose was to remove the Eastern Indian tribes to the west (Pevar 4). Jackson, like so many of the time, rejected the belief that there could be a harmonious relationship between the whites and Indians that would allow peacefully co-existence. With this in mind Jackson felt that removal was the most humane way to deal with ever increasing tensions over westward expansion (Deloria 6). Removal was contingent on the acceptance by the tribe but the president and his representatives used treaties and other means to force compliance (Spicer 46).

The IRA had devastation effects on the IP east of the Mississippi as they were forced out of their homeland into lands foreign to them west of the Mississippi. Almost sixteen thousand Cherokees were moved from their lands in Georgia and forced to walk to their new homes in Oklahoma. This journey has been called the “Trail of Tears” due to the severe conditions in which the Cherokees had to travel (Deloria 7). On the way it has been estimated that four thousand Cherokees lost their lives during the walk (Steiner 320). Other estimates put that close to 8,000 dying as a result of the trek (Thornton 118).

In an attempt to bring American Indians into the fold of the growing American society Senator Henry Dawes of Massachusetts sought to make national policy regarding Native Americans. This policy was to be focused on allotment and assimilation and the passing of the General Allotment Act, or Dawes Act, in 1887 was the first step in the process. This act authorized the president to allot any reservation according to the following formula.

1. To each head of a family, one-quarter section.
2. To each single person over eighteen years of age, one-eighth section.
3. To each orphan child under eighteen years of age, one-eighth section.
4. To each other single person under eighteen years of age living, or who may be born prior to the date of the order to the president directing allotment of the lands, one-sixteenth section.

Over a twenty five year period the Indian owner was expected to learn proper business and farming methods. After that period of that time the land was to be delivered with a free and clear title to the allottee. The Indian at that time would become a citizen of the United States and would come under the jurisdiction of the state in which they lived (Deloria 1997. 9).
The ultimate goal of this policy was to eliminate reservations and push the Indians to live in the general population (Spicer 100).

The surreptitious reason for this act was to remove the Indians from the vast land holdings that they controlled for it was looked upon as impeding the settlement of the western states. This is shown in the land holdings of the IP prior to and after the act. In 1887 the landholdings of the IP consisted of 138 million acres. By the time the Act was stopped in 1934 the IP only controlled 48 million acres and of that almost 20 million acres were desert, semiarid or virtually useless for any kind of farming (Deloria 9-10). In that time 118 out of 213 reservations had been allotted with over three-fourths of the Indians having lived under the act (Wilkins 81). The allotment act held two features that helped reduce the land holdings of Native Americans on reservations. After all the land of the reservation was allotted the “surplus” land was open to white settlement and provisions that allowed allotted land to be taken away to pay debts (Spicer112).

There are recent policy changes that counter the notion that the IP of North America is indeed conquered. The Indian Child Welfare and Religious Freedom Acts of 1978 show how the government has moved from a plan of assimilation to co-habitation. A breakdown of each law shows care and protection of Indian culture and traditions in direct opposition to the forced assimilation policies of the past.

The Indian Child Welfare Act (ICWA) came about after the U.S. Congress investigated the removal of reservation Indian children during the Mid-1970s. Congress found that nearly one-third of reservation Indian children were being removed by state agencies from their homes and placed in adoptive families, foster care or institutions. The results of this investigation showed that state social workers and judges lacked the basic knowledge of Indian culture and traditions or their attitudes were based on prejudices. The ICWA placed restrictions on the courts within the states when it came to resolving custody matters in order to protect Indian children, Indian tribes, and Indian culture. The ICWA was upheld by the Supreme Court in 1989 (Pevar 296)

The procedures established by the ICWA forces states and their courts to follow rule they must follow in order to provide for the welfare of Native American children. The following seven steps are a quick summary of the act.

1. When it comes to jurisdiction, if the child resides on the reservation or is a ward of a tribal court the tribal court has exclusive jurisdiction. Concurrent jurisdiction with the state and tribal court is applied if the child lives off the reservation.

2. When the child lives off the reservation and custody proceedings are initiated in state court the tribal courts and reservations must be notified. At this point the tribe can intervene on behalf of the parent in order to have the case transferred to tribal court. A parent may object and if able to show good cause the case may be kept in state court.

3. While in state court, the court may not terminate parental rights or place a child into foster care without proof beyond reasonable doubt that the continued custody by the child’s family is dangerous to said child.
4. The state has to follow a placement preference in order to place a child in any foster or adoptive home. First a placement is attempted with extended families. Next a placement is tried with other members of the child’s tribe. Finally a placement is tried with other Native American families.

5. If there is a violation of the ICWA the courts decisions can be invalidated by petition from the child’s parent, Indian custodian, or tribes.

6. Custody decisions by the tribal courts have the “full faith and credit” as state court custody decisions.

7. Accurate records must be kept by the state regarding Native American child placement and they must be made available to the federal government and tribes. When an adoptive child becomes eighteen the child has the right to discover their biological parents names and their tribal membership.

The ICWA sets up dual jurisdictional rules that favor the tribe in order to maintain Native American traditional customs and family connections (Pevar 297-98). The effectiveness of the ICWA is still to be determined and this can be attributed to some concerns with the law. One issue is when it is the proper time for tribe to intervene in state hearings. Another issue is for the tribes are the hiring of responsible officials who could observe and participate in the state court proceedings. Some tribes are having problems establishing relationships with children when the issues of multiple tribal ancestries are brought up. This forces reliance upon records from the federal government; which do not take into accounts the complex relationships and responsibilities of extended Indian families (Deloria 215). The First Amendment to the Constitution, in two separate clauses, addresses the issue of religious freedom in the United States. The Free Exercise Clause permits a person to worship or believe in whom and what they want or even not to worship or believe at all. To make sure that the government is not dominated by religion or the church, the Establishment Clause created a wall of separation between religion and government (Deloria 230). The American Indian Religious Freedom Act (AIRFA) of 1978 was passed after congress investigated and found true claims that Indian religious practices were being severely disrupted by the actions of government officials on the state and federal level (Pevar 230). The nature of some religious practices, like the use of eagle feathers and peyote, is alien to many white communities. This competitiveness in religious ideology has allowed in the past the banning of ceremonial or controversial dances like the Sun or Ghost Dance. The federal government also saw in these prohibitions a way to break the cultural connection that would help in the process of assimilation (Deloria 230-232). The House of Representatives issued H.R. Rep. No. 1308 that supported the claims that Indians were prevented from visiting religious sites and denied the use of religious sacraments. Although lacking penalty provisions the AIRFA that passed Congress in 1978 states

[H]enceforth it shall be the policy of the United States to protect and preserve for Native Americans their inherent right of freedom of belief, expression, and exercise of traditional religions of the American Indian...Including but not limited to access to sites, use and possession of sacred objects, and the
freedom to worship through ceremonials and traditional rites. Although additional court rulings have narrowed the scope of the act it still stands as law today (Pevar 230-31).

After examining these selected policies the next focus of the paper, in the debate over the use of the term conquered, will be on select United States Supreme Court decisions. There are numerous court cases involving the IP of North America that support the idea of the term conquered and because of the large number and range of issues of these cases I will discuss Cherokee Nation v. Georgia. Choosing Cherokee Nations v. Georgia is due to the nature of the suit, the time frame, and the implications with other federal policies. The Cherokee Nation in 1827 wrote and adopted its own constitution and proclaimed itself to be independent and hoped to be declared “civilized” in order to live in harmony with their white neighbors. The problem with the 1827 independence proclamation is Georgia, in December of 1828, passed a law to add Cherokee territory to Georgia counties. In 1829 Georgia also passed a law declaring jurisdiction of the Cherokee territory abolishing Cherokee law (Deloria 28). The passing of the 1929 law also forbid the right for a Cherokee to testify or even bring suit in Georgia state court against a white man (Thornton 115-16).

Six days after the passage of the Indian Removal Act Georgia Governor George Gilmer announced the discovery of gold on Cherokee lands. After a proclamation that the gold belonged to Georgia there was an invasion of Indian land by non-native prospectors, which clearly violated the Cherokee’s treaty rights. The Cherokee nation filed suit with the Supreme Court in December 1830 asking for relief from the actions by the state of Georgia (Deloria 28).

The Supreme Court examined the case and ruled that the Cherokee were not a sovereign country and thus could not sue the state of Georgia and dismissed the case (Deloria 1974 8). This case also defined the relationship between the federal government and tribes along with the relationship between the tribes and the states (Deloria 33). The tribes were described by Chief Justice Marshall as a “domestic dependent nation” akin to the relationship of a ward to its guardian (30). The tribes were under the protection of the federal government for which they lacked the sufficient sovereignty to claim independence. However the tribes did possess enough sovereignty to protect themselves from intrusions by the states (33).

The Supreme Court case Minnesota v. Mille Lacs Band of Chippewa Indians, 526 U.S. 172(1999), is a good example from a legal standpoint for the argument that IP of North America are not conquered. The treaty of 1837 was the focal point for the suit brought by the Mille Lacs Band of Chippewa. In the treaty of 1837 the Chippewa retained treaty rights on ceded lands and Article 5 of the treaty stated “The privilege of hunting, fishing, and gathering of wild rice, upon the lands, rivers and the lakes included in the territory ceded, is guaranteed to the Indians, during the pleasure of the President of the United States.” In the suit the band sought to see a declaratory judgment that the band still retained their usufructuary rights under 1837 Treaty and asked for an injunction to
prevent the State of Minnesota from interfering with those rights. (justice.gov)

The Supreme Court’s 5-4 ruling, in favor of the tribe, disposed of the State’s claim that a 1850 Executive Order (EO) which contained a removal order; the court said the President overstepped his authority with the EO by not going through congress. The court also ruled on the merits of how a later treaty may have revoked usufructuary rights. The 1855 treaty was ruled not to have the language “expressly mentioning—much less abrogating—usufructuary rights” that other treaties of the time had (justice.gov).

The Court also ruled that the treaty of 1854, which the Mille Lacs Band was not a signatory, held the same usufructuary rights to hunt fish and gather for those tribes that did sign it. The Court next rejected the argument put forth by the State saying that because Minnesota was admitted to the Union in 1858 it automatically negated the usufructuary rights of the Chippewa (justice.gov).

The ICWA and AIRFA along with the recent Supreme Court ruling in the Mille Lacs Band’s case show that the federal government does not look at the tribes in the United States as conquered but as sovereign nations living within another sovereign nation.

Cultural and language revitalization of the IP of North America has been steadily growing and this can be seen in the amount of Native American/Indian museums, and tribal colleges and universities that teach indigenous language and culture. The fact that numerous Native American museums exist today show that the IP do not fall under the conquered status and their culture is actually embraced and celebrated. On the national level the Smithsonian Institution opened up the National Museum of the Native America (NMNA) in Washington D.C. on September 21, 2004. This museum houses one of the largest collections of Native American artifacts and provides a unique look into Native American world. The NMNA mission statement reads as such.

The National Museum of the American Indian (NMAI) is committed to advancing knowledge and understanding of the Native cultures of the Western Hemisphere—past, present, and future—through partnership with Native people and others. The museum works to support the continuance of culture, traditional values, and transitions in contemporary Native life.

This mission statement is evidence that supports my claim (nmai.si.edu).

Outside of the NMAI there are other museums large and small that document the lives of Native Americans from pre contact to contemporary times. These museums can be privately started or state funded. The Heard Museum in Phoenix Arizona was started by Dwight and Maie Bartlett Heard in June of 1929 for the purpose to educate people about the lives of the IP of North America. With an emphasis of the Southwest American Indian tribes, the Heard Museum is internationally recognized for its artifact collection, the community outreach and festivals that center around the life and ways of the IP. With over 40,000 pieces in the collection the Heard Museum is most noted for its 1,200 Kachina dolls made by the Hopi Indians. The Heard Museum also supports
contemporary Native American artist by holding artists demonstrations and major festivals throughout the year. The Heard is also a great resource for those interested in Native American art. The Billie Jane Baguley Library and Archives has an American Indian Artist Resource File containing 25,000 records about Native American artist and is a great research resource for those interested in art history (heard.org).

In Minnesota there are several museums and monuments centered on the life and culture of the IP of the area. On the national level The Grand Portage National Monument is part of the National Park Service system that provides an opportunity to see the history of the Anishinaabeg people and their contact with the traders of the North West Company. During the second weekend in August the annual Grand Rendezvous is held in conjunction with the Grand Portage Band of Lake Superior Chippewa Pow wow participants and fur camp re-enactors gather together to enjoy the rich cultural heritage of the past and continue a tradition of storytelling and the bartering of goods (nps.gov/grpo).

The Minnesota Historical Society, along with telling the history of the state, provides unique opportunities to better understand the Native American culture and history. A good example of this is the North West Company Fur post in Pine City. This living re-enactment of the first contact in September 1804 by fur traders and the Anishinaabeg gives visitors a chance to see what life was like during that time (mnhs.org/nwcfp).

Tribal museums like the one on the Fond du Lac Indian Reservation show how tribes are insuring themselves the preservation of their culture. The Fond du Lac Cultural Center and Museum is a resource that allows people to not only search the past but be a part of the present. This is done by the working with local schools to provide a space to promote hands on knowledge of Anishinaabeg culture. Every year students learn to make culturally important items that are still used today for example birch bark canoes and fanning baskets, handmade wild rice harvesting tools, and beading techniques (fdlrez.com/museum).

The growth of the tribal college in America also gives credence to the non-conquered belief. According to the U.S. Department of Education there are thirty six tribal colleges and universities in fourteen states. These include Alaska, Arizona, Kansas, Michigan, Minnesota, Montana, Nebraska, New Mexico, North Dakota, Oklahoma, South Dakota, Washington, Wisconsin, and Wyoming. Montana has the most with seven institutions of higher learning dedicated to Native Americans (ed.gov).

In these colleges, along with some state and private colleges and universities, language and cultural classes are offered. In Minnesota, 24 two year colleges and seven four year institutions make up the Minnesota State College and Universities (MNSCU) educational organization. This system, separate from the University of Minnesota, was created in 1995 to merge the state’s community colleges, technical and tribal colleges and universities into one system. Four of these schools offer certificates in the Ojibwe language for teaching purposes with Bemidji State offering a B.A. in Indian Studies (mnscu.edu). The University of Minnesota’s main campus, along with its Duluth and Morris campuses have majors and minors in
American Indian Studies. The University of Minnesota, Duluth as well offers a graduate program in Tribal Administration and Government that trains future Native leaders in the ethical ways of tribal governance and management (umn.edu).

Private colleges in Minnesota as well see the importance of sharing the culture and language of the IP. Augsburg College in Minneapolis has an undergraduate degree program in Native American Studies. This program, started in 1978, was developed around the community aspect of learning and sharing of cultural identity developed from the “spirit” of the Native American activist movements of the 1960’s and 70’s (augsburg.edu). The College of St. Scholastica in Duluth offers a major in Ojibwe language and Cultural Education and a minor in American Indian Studies. The Native Teachers Program offered at St. Scholastica prepares elementary and secondary teachers to step into the public, private and tribal schools with a better understanding of the Anishinaabeg culture and language (css.edu).

Discussion and Questions

When sitting down and going over the information provided by the selected authors I kept thinking of more and more questions that could lead to other research projects or papers. The foremost question is about the continued use of team mascots derived from Native Americans and clichés like “off the reservation” when describing someone not acting appropriately. It would support the notion that the IP are conquered because why else would certain teams keep offensive names like the National Football League’s Washington Redskins or offensive characters like the one used by Major League Baseball’s Cleveland Indians. Why else would people so off handedly use the term “off the reservation”? Daniel Johnsons’ study From the Tomahawk Chop to the Road Block examined these questions. Johnson wrote that the imagery has become so “engrained, accepted and normalized” that most people and the media do no question their use even when faced with continued calls for change.

Growing up I was taught by my elders that the drum is culturally important to my tribe and my very existence. The shape of the drum represents the circle of life. The beat of the drum represents the heart beat of every living creature on the planet and the planet itself. So when I see and hear John Adams, a 60 year old Cleveland Indians fan, beating a drum at the home games for the Cleveland Indians I get angry. The drum used by Adams was named Big Chief Boom-Boom soon after he started bringing it to games in 1973. Now according to Adams he beats the drum to cheer up his beleaguered team but that is not an excuse to us such a culturally sensitive item for fanaticism (nytimes.com). This story about Adams supports the premises brought up by Johnson in his paper. How would Catholics feel if someone went to a San Diego Padres baseball game and used a thurible while they walked up and down the aisles censing everyone? I am sure it would not be accepted to well by those who witness it.

Conclusion

When deciding if the use of the word conquered is appropriate for the description of the IP of North America one can say it is not. Research shown about past policies and procedures does indicate an
attempt at conquering of the IP by the federal government. Yet the existence today of many federally recognized tribes and policies that support the rights of the IP is counter to the idea that the IP is indeed conquered. Understanding tribal survival along with heightened cultural awareness in society today shows a different relationship between the U.S. government and the IP. This current relationship is not of the conqueror and the conquered but one of understanding and co-habitation.

Resources


Can You See Beyond The Smoke?

Laurel O. Ohaju, Nursing
Shirley Slettedahl, MSA, MSN, RN
The College of St. Scholastica
School of Nursing

I. Introduction

Explosions, smoke so thick you cannot even see your hand out in front of your face, and a multitude of death. Usually, we think of a scene like this during a war, but what about on a college campus? Students who attend college encounter an alluring, deceptive, and ghostly predator. The predator prowls, and then enters the bodies of innocent victims against their own will; the guilty culprits freely allow the predator to invade their own bodies, and at this stage both groups of people now succumb to health problems. Tobacco products breed this slick assassin, and unless something is done to slay this predator, it will continue roaming the air until it finds its next victim to prey on. As a third year non smoking college student, I can attest to encountering this environmental hazard even though my college implemented a tobacco-free policy. The beneficial effects of a tobacco free campus on individuals still using tobacco products are nonexistent.

Tobacco use creates a large social community, one that is hard to break up or get rid of in general. When this aspect of life is revoked, one would assume that broad benefits would accrue for the general population at the expense of social interaction, but this is not so. The primary goal of this present study was to validate a theory on tobacco cessation; that smoking cessation programs have little to no effect on curbing the usage of tobacco products by current smokers. To the best of my knowledge, this is original research, in which there was a gradual build up to the conclusion. Three primary propositions that may have been overlooked by the prevalence of tobacco products on a campus are:

1.) Personal use or unintentional inhalation of tobacco products via air pollution or via social interactions create health problems. This is an eye opening problem because of the notable health complications that result as aftermath of tobacco use. The four health concerns most associated with tobacco use are, coronary artery disease, lung cancer, chronic bronchitis, and emphysema (Warner, 2002). The rise of these diseases will be discussed below, along with other concerns dealing with the diseases. These diseases are affecting people as young as 18-24 years old (Green, et al., 2007).

2.) Non tobacco-free colleges are wanting to take up a tobacco-free policy to become tobacco free to help protect their students, smoking and non-smoking, as well as their environment as a whole (York, et al., 2008). Since 18-24 year olds are the main group of people using tobacco products, it is understandable that current non tobacco-free colleges want to move towards being tobacco-free since tobacco use among this age is seen as a
growing health concern (Rigotti, Regan, Moran, & Wrechsler, 2003). College campuses are a breeding ground for influences for those students who can be easily persuaded and even those who think they can withstand temptation. It was stated above that the health concerns related to tobacco use are increasing, and since college students make up a big part of that increase, enforcing a tobacco-free policy on college campuses may help lower the number of tobacco products being consumed, and ultimately lower the number of acquired diseases that are associated with tobacco use.

3.) Lastly, testimonials from a number of tobacco-free workplaces stated how after a tobacco-free policy was established, improvements occurred (Dominello & Woodward, 1999, Fichtenburg & Glantz, 2002, and Bauer et al., 2005). Deviations away from current smoking statuses were identified with current tobacco users. Seeing the progress that was made from over thirty workplaces that took the initiative to abide by a tobacco-free policy is encouraging. This same progress may be true for other communities that enforce such a policy, like college campuses. A survey was randomly issued, via email, to students between two college institutions to see if the students, smokers or non-smokers, benefited from the tobacco-free policy. After collecting this data dealing with the tobacco-free policies on the two college campuses, the results confirmed that tobacco-free policies are indeed not having positive effects on college campuses.

The next three sections discuss the reasons why schools wanted to move towards being tobacco free. These reasons entail health concerns and the general well being of the campus’ students, faculty, and campus environment as well as the health of the general public that surrounds the campuses, cigarette butts affecting waterways, and success stories of smoke-free workplaces.

II. Literature Review

Health Risks

Eighteen to twenty-four year olds are still trying to figure out life through experimentation or learning from mistakes and then other issues may arise and overwhelm the young adult. These issues sometimes lead the person astray and can foretell where their health is going to lead to. Social interaction, curiosity, stress, or relationship problems are all things that can contribute to the start or continuation of smoking for college students. Although good health is something that plays an exceedingly crucial role in one's life, this role is usually overlooked to meet the person's need for instant gratification, thus students use tobacco products. Students may use other medians such as alcohol or violence, but examples of tobacco use will be the main focus of this section. Though tobacco products may quench a person's stress from whatever they may be going through, the product also instills a burden upon the individual in exchange for its services. The four most reported findings due to tobacco association include: coronary artery disease, lung cancer, chronic bronchitis, and emphysema (Warner, 2002).
“Cigarette smoking is the most important of the causes of chronic bronchitis in the United States, and increases the risk of dying from chronic bronchitis and emphysema. Studies demonstrate that fatalities from this disease are infrequent among non-smokers” (Warner, 2002). Since thousands of people were dying annually due to these diseases; some college administrators recognized this as a problem and wanted to head towards going tobacco-free.

In previous studies, the use of tobacco, especially cigarette smoking, has been causally linked to several diseases. Such use has been associated with increased deaths from lung cancer and other diseases, notably coronary artery disease, chronic bronchitis, and emphysema. These widely reported findings, which have been the cause of much public concern over the past decade, have been accepted in many countries by official health agencies, medical associations, and voluntary health organizations. The potential hazard of acquiring one of these diseases is great because these diseases are major causes of death and disability, and the statistics of these deaths have been increasing over the years.

A reason why this is a cause for concern is that deaths from some of these diseases have been increasing with great rapidity over the past few decades. Lung cancer deaths, less than 3,000 in 1930, increased to 18,000 in 1950. In the short period since 1955, deaths from lung cancer rose from less than 27,000 to the 1962 total of 41,000 (Warner, 2000). This is an extraordinary rise, and unfortunately a large amount of people have to die until eyes get opened up to see the bigger picture. Once we continue to look at a different aspect of disease we will see the deaths from arteriosclerotic, coronary, and degenerative heart disease rose from 273,000 in 1940, to 396,000 in 1950, and to 578,000 in 1962 (Warner, 2000). Lastly, reported deaths from chronic bronchitis and emphysema rose from 2,300 in 1945 to 15,000 in 1962 (Warner, 2000). Once we recap this, we can see that in 1962 alone, over 500,000 people in the United States died of arteriosclerotic heart disease (principally coronary artery disease), 41,000 died of lung cancer, and 15,000 died of bronchitis and emphysema (Warner, 2000) due to smoking related habits. Once we skip over a few years we can see that there were an average of about 290,000 smoking-related deaths in men each year between 2002 and 2006 and 230,000 in women (Pittman, 2011).” The numbers of death does not halt there, Pittman further explains that about 2.5 million people in the U.S. die every year, according to the Centers for Disease Control and Prevention (2011).

The changing patterns and extent of tobacco use are a pertinent aspect of the tobacco-health problem. It is common knowledge that death from smoking is attainable, but what is not common knowledge is the amount of deaths that occur per year due to smoking related habits. Waiting for a small problem to grow into a larger problem is an area in which we experience a downfall. Society tends to overlook a bad outcome of one person until the bad outcome has a domino effect on a multitude of people, then eyes are opened and meetings are held to see what can be done to alleviate the problem, but why must we wait until these situations occur? We should be dealing with the problem at its source. We cannot expect to put a fire out by aiming the water source at the top of the flames.
**Heading Toward Being Tobacco-Free**

The increasing health complications of tobacco use, prompted colleges to move towards or to establish a tobacco-free policy on their campus to protect the non-smokers, as well as hoping the policy would decrease the number of tobacco products consumed by the smoking population (Seo, et al. 2011; York, et al. 2008). Many students, smokers and non-smokers, agree with the push towards a tobacco-free college. Inclusively, in the past, tobacco control policies for U.S. colleges and universities have been proposed by several groups in order to counter the rising use of tobacco by students enrolled in these institutions. Rigotti, Regan, Moran, and Wechsler (2003) conducted a study on students’ opinion of seven proposed tobacco control policies because student opinion of these policies were not known, and concern about student opposition was one barrier that has deterred administrators from adopting the policies. After the investigation of this study, Rigotti, Regan, Moran, and Wechsler (2003) noted, “Student support for proposed campus tobacco control policies is strong, even among smokers, and broadly based across demographic subgroups. These findings should provide reassurance to college administrators who are considering adopting these policies.” Successes such as these are what encouraged colleges to go further with protecting their students. Even though support for tobacco-free policies were underway, this did not mean that a tobacco-free policy was going to change the intentions or smoking habits of current smokers. The fact that students were convincing their administrators that tobacco-free policies would be appreciated changed the social norm of tobacco use.

When change, or thoughts of change, is looked at on a large scale, change draws attention to the main focus of the problem, which in this case was smoke-free campuses.

At two recent campus clean-ups in San Diego, California, obsessive amounts of cigarette butts were obtained on two tobacco-free college campuses. Cigarette waste consisting primarily of filters are the most common form of litter worldwide and are considered toxic waste due to the environmental leachates such as nicotine and ethylphenol and the non-biodegradable cellulose acetate used to make cigarette filters (Sawdey, Lindsay, & Novotny, 2011). Even though cigarette butts contain such harmful substances, they are still tossed carelessly and effortlessly on the ground on college property. The wind may complicate this irresponsible act by dropping cigarette butts in waterways.

As non tobacco-free colleges move towards becoming tobacco-free, thoughts of alleviating some of these detriments are considered to be the ultimate goal. According to the Americans for Non-Smoker’s Rights Foundation (ANR), as of January 2011, 466 out of 4409 (approximately 10.6%) college and university campuses are 100% smoke free (Sawdey et al. 2011). From this, we can see that an optimal goal of tobacco-free colleges is still a long journey away, which means optimal health is even farther away. However, since there are 466 colleges that are tobacco-free, this too welcomes and entertains the thoughts of other college institutions becoming tobacco-free campuses. Much of the focus is heading towards becoming a tobacco-free institution; some of the focus should be on
institutions that have gone tobacco free, and whether the program is successful.

Smoke-free Workplaces

Since there was not any evidence of the positive effects of tobacco-free policies on college campuses during data collection, testimonials from smoke-free workplaces will be discussed. The tobacco-free policies at 26 workplaces helped the employees reduce cigarette consumption as well as quit smoking.

Generally speaking, the more restrictive the smoking policy, the greater the likelihood that individuals were successful in quitting smoking or in lowering their daily cigarette consumption if they continued to smoke. People whose workplaces restricted smoking were 1.9 times more likely to have quit smoking by 2001 than people whose workplaces did not restrict smoking. Those who worked in smoke-free environments but continued to smoke reported reducing their average daily consumption by about 2.5 cigarettes per day (Bauer, Hyland, Li, Steger, & Cummings, 2005).

This is an important quote to focus on because the key words in this quote are more restrictive. It is not enough to just establish a tobacco-free policy and assume that change will occur, but yet the policy needs to be enforced to meet the intended goal of the institution otherwise administrations might as well not establish a policy because institutions will get the same result, a continuation of smoking on campus. “Conversely, employees who worked in places where smoking was permitted without restriction were more likely to smoke 25 or more cigarettes per day and have little desire to quit” (Bauer, Hyland, Li, Steger, & Cummings, 2005). The success tool that is needed in order to get the results that were intended originally is to increase a college’s attention to enforcement of the policy, because without enforcing a policy to the fullest there is no point in establishing the policy at all. Colleges will be strict with their sexual harassment policies, their bullying policies, or their fill-in-the-blank policy, but why are colleges being so lenient with their tobacco-free policies? It is time that we looked at the real issue. The issue is not only the fact that college students are disobeying the tobacco-free policies, but the problem is so much more than this.

III. Methodology-Survey

The issues that college tobacco-free colleges are dealing with are students disobeying the tobacco-free policies because enforcement of the tobacco-free policy is not being seen, as well as no form of consequences are being carried out by administrators or authority figures on campus. Smoking cessation programs have no effect on curbing the usage of tobacco products on current smokers. Ideally, collecting data from adult smokers and non-smokers attending the three tobacco-free original intent, but due to time requirements for this study, only two of the three colleges were able to participate. The two colleges that were able to participate were the University of Minnesota Duluth (UMD) and Lake Superior College (LSC). Distributing the surveys via email was the most precise way to get an accurate representation of 10 percent of the student population at both of the colleges. Once approximately 10 percent of the student population at each of
the two colleges were discovered, they were then recruited to participate in the online survey, Appendix 1, using a survey tool called Qualtrics, the College of St. Scholastica’s official survey device. The questions specifically centered around tobacco use to ultimately see if students were or were not affected by the tobacco cessation program. Students that were eligible to participate were students that were over 18 years old and were a full-time spring semester student; this excluded part-time students, online students, and post-secondary education students or college in the schools students also known as CITS students. These parameters represent a fair and consistent result between the two colleges. At the University of Minnesota Duluth, there was a total student population of 3,000 that met the criteria. Alike, at Lake Superior College, there was a total student population of 146 that met the criteria needed for this study. These two figures, the 3,000 from the University of Minnesota Duluth and the 146 from Lake Superior College, represented the student population as a whole at each of the colleges.

IV. Analysis/Result

Despite all of the health complications, efforts to move towards tobacco-free policies, and even testimonials stating effective tobacco-free policies, it has been proven through this study that tobacco-free policies are not positively effecting current tobacco users. The random sample size from the University of Minnesota Duluth was 3,000. Out of the 3,000 students from the University of Minnesota Duluth 248 responded to the survey. From the 248 responses 233 students completed the survey, which was a 94% completion rate.

Demographics: 43% of the students were male and 56% of the students were female, and 1% did not wish to tell their gender. Most of the respondents were Caucasian comprising a total of 89%, 2% were Asian, 1% were American Indian or Native Alaskan, and 6% did not wish to share their gender. The first question dealing with the tobacco policy was question 4, which stated since your campus went tobacco-free do you feel you have used tobacco products less, the same, more, or I do not use tobacco products, and 65% stated they do not use tobacco products, 27% stated they use tobacco products the same amount, 4% said they use it less, but another 4% stated that they use tobacco products more. Question 5 stated do you try anything instead of using tobacco products whether it is go for a run, eat a certain type of food, I have not tried anything to stop using tobacco products, or I do not use tobacco products. In the event of answering this question a total of 70% of the students do not substitute tobacco products for something else because they do not use tobacco products. A large number of 23% have not tried anything to replace tobacco products, 3% eat a different food, and another 3% go for a run as a tobacco use alternative. Question 6 said have you been offered a tobacco cessation program, and 71% of the surveyors said they were not offered a tobacco cessation program because they did not use tobacco products. A total of 18% of the tobacco users said they were not offered a cessation program, nor did they want to participate in one. A low number of 5% said they were not offered a program, but they are thinking about it. Another 5% said they were offered a program, but they do not want to participate in one, and the remaining 2% joined a program because they were offered one, but later quit the program. Question 7
is represented by Graph 1, answering the question do you still use tobacco products on your campus.

![Graph 1](image1)

Only 10% of the students who use tobacco products do not use tobacco products on campus, but 22% still use tobacco products on campus. Question 8 said when using tobacco products on your campus have you ever been told to stop by a student or faculty member. Graph 2 shows the percentage of tobacco users who have been told by a student or faculty member to stop smoking when they have been caught doing so on campus.

![Graph 2](image2)

Question 9 asked, if you do not use tobacco products on your campus then where do you use them, mark all that apply. When asked this question 19% of the tobacco users said they use tobacco products near an outside trash can or cigarette disposal and 16% of the tobacco users use tobacco products in their vehicles. However, 24% of the tobacco users claimed to use tobacco products off campus. The last question implied or suggested a benefit from the tobacco-free policy. A total of 16% of tobacco users testified zero benefits; 6% of the tobacco users said less smoke odor found on clothing and in the air said, 3% of the tobacco users obtained more rest, and 2% of the tobacco users experienced less coughing or clearing of the throat. Other direct comments from the surveyors were: It doesn’t stop anyone (the tobacco-free policy)

1. There is no benefit to a smoke-free campus other than some people have less to complain about
2. Haven't experienced any benefits
3. No benefits
4. I chew tobacco and this causes no shortness of breath or smoke odor to other individuals. That being said a smoke (or all tobacco) free campus is pointless because not everyone will follow the rules. Even professors are often times seen smoking on campus.
5. People still smoke everywhere on campus
6. Lifestyle is still the same. I still smoke regardless.
7. There are little benefits to this. It can't be enforced so students will do it any way. I don't see
8. Many, if any, benefits. Try promoting healthier habits and go about marketing non-smoking better. Tobacco free focuses too much on people who already use tobacco.
10. No I have not felt benefits. The tobacco ban is pointless
11. Not a benefit, but there is a lot more butts around the doorways now that they took out all the ash trays. It’s ridiculous
12. People congregate in certain areas hidden away from main walk ways to smoke
13. Decided to quit
14. No, the program doesn’t affect me.

The random sample size for LSC was 146 students. Out of the 146 students 2 surveys were started and 1 survey was completed. The surveyor was an African American female between the age of 18-22. Since her campus went tobacco-free she said she has smoked less. Instead of using tobacco products this respondent eats a certain type of food. The respondent has not been offered a cessation program but she has been thinking about it. The respondent claimed to not use tobacco products on campus, and has experienced less smoke odor on clothing/ in the air and has obtained more energy. This testimony is outstanding, however since only one person has replied to the survey from Lake Superior College it is still difficult to see if the policy is truly working at this institution.

V. Discussion

Conversations pertaining to tobacco users quitting their smoking-related habits have always been in existence on college campuses, because administrators want to decrease smoking-related habits on their campus until the habit is absent. However, I have yet to stumble upon a way to decrease tobacco use in a dramatic community way. Tobacco-free communities have tried using a tobacco-free policy to reap multiple decreases in tobacco use. It is important to prove that these benefits are coming to pass because if they are not then what progression have we made?

Before the tobacco-free policy was established, it was blatant that students were smoking on campus. Cigarette smoke around doorways or in the air in general were inevitable. Students were not trying to stop using or use less tobacco products because they did not think they had any reason or need to do so. Smoking is a big social event in the eyes of those who use tobacco products as a means of social interaction. However, this form of social communion started to affect the health of outside sources as well as the people belonging to this group, so in efforts to help the campus as a whole a tobacco-free campus policy was established.

The biggest question an administrator could seek or should be seeking is whether or not the tobacco-free policy is helping students smoke less. According to the subsequent results for this research the tobacco-free policy is not adequately helping current smokers smoke less overall. If we revert back to questions four, seven, and ten we can see this evidence confirmed. From question four, 27% of the students said they were not affected by the policy because they still smoke the same amount since the policy was established. From question seven, 23% which is 54 students said they still smoke on campus. We have to keep in mind here the total number of students completing this survey was 234 and of this 162 students do not use tobacco products, which leaves 72 students that do use tobacco products, and 54 students, which is almost the entire tobacco user.
representation for this study, still use tobacco products on campus. In question ten, 16% said they experienced zero benefits, and since zero benefits were discovered then the need to quit or lower their smoking habits decreased. Considering the fact that students are not smoking less contributes to the level of smoking prevalence on campus.

The findings suggest the level of smoking prevalence on the University of Minnesota's campus has gone up since the tobacco-free policy was initiated. Before the policy was established and students smoked it was not looked down upon so harshly because smoking on campus was kind of a social norm. However, once the tobacco-free policy was set up the policy skewed the social norm and turned the social norm into a taboo. Now, for some people going against taboo's fulfills their inner rebel, and if we look at question four again we can see that 4% of the students needed to satisfy their inner rebel because this 4% started smoking more since the tobacco-free policy was set up. Again, in question seven those 54 students that are still using tobacco products on campus are not helping decrease the prevalence on campus. When we begin to think about why the prevalence of tobacco use on campus is increasing, it all goes back to if or how well the tobacco-free policy is being enforced.

According to questions...we can see how well the tobacco-free policy is being enforced on campus. The results to these questions tell us that the tobacco-free policy is not being enforced well enough on campus. Also, reverting back to student opinion number 5 from question ten of the survey a student said, “I chew tobacco and this causes no shortness of breath or smoke odor to other individuals. That being said a smoke (or all tobacco) free campus is pointless because not everyone will follow the rules. Even professors are often times seen smoking on campus.” If a faculty member, an authority figure, cannot follow the tobacco-free policy then how can we expect our students to follow the policy? If students are not allowed to do something that they want to do they will always try and look for a loophole, we cannot give them one so easily as this, in the sense that if a student sees a faculty member not complying with the tobacco-free policy this situation gives the student incentive to not follow the policy either.

VI. Limitations

In order to improve the accuracy of the results to this research, a follow up on a college with out hidden locations on campus would be recommended. Also, since the response rate at Lake Superior College was only 1% this also put a limit on the results, so it is still up for discussion whether the tobacco-free policy is indeed working on this campus.

VII. Conclusion

This study has proved that little to no progression on decreasing the amount of tobacco use on tobacco-free campuses has been made since a tobacco-free policy has been made. Establishing a tobacco-free policy has implied, instead of blatant benefits. In order to see change or benefits on a tobacco-free campus, administrators as well as other authority figures need to enforce the tobacco-free policy because as we have seen, just saying that a college is tobacco-free is not doing enough justice. Though tobacco-free policies are not
working on college campuses, this does not mean that tobacco-free colleges have failed. However, this event brings to our attention and opens our eyes to see that our efforts need to be improved. We may have lost this battle, but we will not lose the war.
Appendix 1

The College of St. Scholastica

“Can You See Beyond the Smoke?”

Informed Consent Done Internet

You are invited to participate in a research study investigating the effects of the new tobacco-free policy on Scholastica’s students. This study is being conducted by Laurel Ohaju under the supervision of Shirley Slettedahl. Laurel is an undergraduate student in the Department of Nursing. You were selected as a possible participant because you are a student at the College of St. Scholastica (CSS). A random list was generated from all students.

Study Purpose

The beneficial effects of a tobacco free campus on individuals still using tobacco products are astonishing. Tobacco use is a huge social communion. When this aspect of life is revoked, economical benefits reign. The primary goal of this research is to validate the theory on tobacco cessation. When a tobacco-free community is formed, then what kind of benefits, if any, can arise from this. Thus, the theory is formulated, the beneficial effects of a tobacco free campus on individuals still using tobacco.

Study Procedure

If you agree to participate in this study, we will ask you to complete an online survey.

Risk of Study Participation

There are minimal risks for your participation with this survey. Some participants may experience slight discomfort when answering health-related questions. There is a risk of your answers being viewed by researchers or staff members, however, there is no way the researchers or staff can differentiate whose answers they are.

Benefits of Study Participation

There are no direct benefits towards the participant.

Confidentiality

The records of this study will be kept private. In any publication or presentations, we will not include any information that will make it possible to identify you as a subject. Your record for
the study may, however, be reviewed by individuals at CSS with appropriate regulatory oversight. All data collected will be stored in a locked filling cabinet by a McNair staff and/or on a password protected computer. To these extents, confidentiality is not absolute. Your consent form and data will be retained securely for five years after which time it will be destroyed.

**Voluntary Nature of the Study**

Participation in this study is voluntary. Your decision whether or not to participate in this study will not affect your current or future relations with CSS. If you decide to participate, you are free to withdraw at any time without affecting those relationships.

**Contact and Questions**

The researcher conducting this study is Laurel Ohaju. You may ask any questions you have now, or if you have questions later, you are encouraged to contact her by email at lohaju@css.edu. If you have any questions or concerns regarding the study and would like to talk to someone other than the researcher, you are encouraged to contact the following individuals:

- Research Advisor - Shirley Slettedahl (ssletted@css.edu)
- McNair Scholar TRiO Program Coordinator - Celeste Zuniga (218-625-4833)
- Chair of the Institutional Review Board - Robert Hensley, Ph.D. (218-723-6627)

You may contact any of the above-named individuals in writing or in person at The College of St. Scholastica, 1200 Kenwood Ave, Duluth, MN 55811.

Signature:               Date:

*You are about to begin the survey!*
For each of the following questions, please select the circle that best describes your answer.
Appendix 2

Can You See Beyond the Smoke?

1. What age group are you associated with?
   A.) 18-22
   B.) 23-30
   C.) Older than 30 years old
   D.) Do not wish to tell

2. What gender are you?
   A.) Male
   B.) Female
   C.) Do not wish to tell

3. What race or ethnicity best describes you?
   A.) American Indian or Alaska Native: A person having origins in any of the original peoples of North and South America (including Central America), and who maintains a tribal affiliation or community attachment.
   B.) Asian: A person having origins in any of the original peoples of the Far East, Southeast Asia, or the Indian subcontinent including, for example, Cambodia, China, India, Japan, Korea, Malaysia, Pakistan, the Philippine Islands, Thailand, and Vietnam.
   C.) Black or African American: A person having origins in any of the Black racial groups of Africa- includes Caribbean Islanders and other of African origin.
   D.) Native Hawaiian or Other Pacific Islander: A person having origins in any of the original peoples of Hawaii, Guam, Samoa, or other Pacific Islands.
   E.) White: A person having origins in any of the original peoples of Europe, the Middle East, or North Africa.
   F.) Hispanic or Latino: A person of Cuban, Mexican, Puerto Rican, South or Central American, or other Spanish culture or origin, regardless of race.
   G.) Do not wish to tell

4. Since your campus went Tobacco free, do you feel that you have used tobacco products:
   A.) Less
   B.) The same
   C.) More
   D.) I do not use tobacco products

5. Do you try anything instead of using tobacco products?
   A.) Go for a run
   B.) Eat a certain type of food
   C.) I have not tried anything to stop using tobacco products
   D.) I do not use tobacco products

6. Have you been offered a tobacco cessation program?
   A.) Yes, and I am still in the program
   B.) Yes, and I quit the program
C.) Yes, but I am not interested
D.) No, but I am thinking about it
E.) No, and I do not want to participate in a program
F.) No, because I do not use tobacco products

7. Do you still use tobacco products on your campus?
   A.) Yes
   B.) No
   C.) I do not use tobacco product

8. When using tobacco products on your campus, have you been told to stop by another student or faculty?
   A.) Yes
   B.) Sometimes
   C.) Never
   D.) I do not use tobacco products on campus
   E.) I am a non-tobacco user

9. If you do not use tobacco products on your campus where do you use them? Mark all that apply.
   A.) In your car
   B.) Off campus
   C.) Near an outside trash can or a cigarette disposal
   D.) I am a non-tobacco user

10. As a tobacco user, have you felt any benefits since your campus went tobacco-free? Mark all that apply.
    A.) I am not a tobacco user
    B.) Less smoke odor on clothing or in the air
    C.) Obtained more energy
    D.) Experienced less coughing or clearing of the throat
    E.) Have obtained more rest
    F.) If other, please explain: __________________________________________________________

Thank you for completing this survey! Please press "Submit" to finish
References


Anonymous. (N.D.). What can public health learn from the tobacco industry about disparities in smoking? Tobacco Control, 13,115–120. Doi: 10.1136/tc.2003.006098


Cardiovascular and Cortisol Reactivity and Recovery: Effects of Physical Activity

Brittanny Polanka, Psychology
The College of St. Scholastica

Mustafa al’Absi, Ph.D. and Motohiro Nakajima, Ph.D., Mentors
University of Minnesota - Duluth
Department of Biobehavioral Health and Population Sciences

Abstract

The purpose of this study was to investigate the effects physical activity has on cardiovascular and adrenocortical reactivity and recovery. Participants (N = 58) completed a laboratory session that included baseline, stress (public speaking, mental arithmetic, and cold pressor), recovery 1, and recovery 2 periods. Cardiovascular (SBP, DBP, and HR), hormonal (cortisol), and mood measures (distress and positive affect) were collected during each of these periods. Stress protocol induced the expected changes in cardiovascular and hormonal measures. Results indicate that high physical activity may increase SBP reactivity and amount of recovery as compared to those who engage in low physical activity. Cortisol did not differ by period; however, a main effect of physical activity revealed that the low physical activity group had a higher overall mean than the high physical activity group.

Introduction

Psychophysiological Stress Response

When we perceive an event as stressful there are certain physiological changes that occur to prepare our bodies to handle the situation. The sympathetic nervous system controls cardiac muscle cells and prepares the body, specifically the heart, for vigorous activity such as fight-or-flight responses (Lovallo, 2005). This cardiovascular response includes an increase in heart rate and blood pressure. The sympathetic nervous system responsible for this cardiovascular response works together with the endocrine system to enhance the cardiovascular response.

The main endocrine system that responds to stress is the hypothalamic-pituitary-adrenal axis (HPA-axis). During times of stress the adrenal medulla secrets epinephrine and norepinephrine (Lovallo, 2005). These hormones enhance the cardiac response by stimulating alpha- and beta-adrenoreceptors. Other important hormones of the stress response include corticotropin-releasing factor (CRF) and adrenocorticotrope hormone (ACTH). Once an event is perceived as stressful, the paraventricular nucleus of the hypothalamus will immediately produce CRF, which then stimulates the anterior pituitary gland to secrete ACTH. After ACTH has been released into circulation it travels to the adrenal cortex and stimulates the release of cortisol. This hormone is essential for regulating the body during stress or fight-or-flight situations. Cortisol synthesizes and regulates the function of alpha- and beta-adrenoreceptors. These adrenoreceptors, when activated by epinephrine, are responsible for enhancing cardiac output, liberating stored fatty acids...
from adipose tissue, stimulating glucogenisis, and inhibiting insulin (Lovallo, 2005). All these functions are made possible by cortisol’s maintenance of the adrenoreceptors, which prepare the body to deal with the stressor by making fuel (glucose and fats) available and keeping the body from storing the glucose (insulin inhibition).

A normal functioning cortisol response to stress has what is called a negative feedback loop in order to turn itself off after the cortisol has done its job to aid in preparing the body for fight-or-flight. When cortisol levels are high, it signals the pituitary gland to stop secreting ACTH and the hypothalamus to cease the secretion of CRF. This short-term response of cortisol is adaptive and necessary to ready the body. However, if the stressor continues to stimulate the HPA-axis or there are continuous stressors with little time for recovery in between, then it becomes a long-term response that can have damaging effects. For example, after the HPA-axis is repeatedly turned on the body will eventually become less responsive to ACTH, which results in compensatory action of the pituitary to release more ACTH and the adrenal gland to release less cortisol (Kraemer & Rogol, 2005). In other words, the body becomes less capable as it becomes overloaded with stress during long-term stressors. Hypercortisolism can result in the suppression of the immune system in the form of autoimmune diseases due to the immunosuppressant nature of glucocorticoids (Guilliam & Edward, 2010). This condition of prolonged cortisol production can also promote visceral adipose deposition, leading to diseases such as cardiovascular disease, hypertension, hyperlipidemia, and insulin resistance.

Physical Activity and the Stress Response

The body interprets physical exercise as a stressor and it induces a very similar response. However, there are some differences between the responses for psychophysiological stress and exercise. One difference is how the HPA-axis response is triggered. In psychophysiological stress, the CRH produced by the PVN is released in response to the situation. In contrast, the drop in blood glucose during exercise induces the PVN to produce CRH in order to start the cascade of hormonal responses. Another difference is the cardiovascular adjustment to the physical demands of exercise. During physiological stress the muscles are only prepared to work should physical action be required, but during exercise they are being worked as the response occurs. This difference is accompanied by an enhanced return of the blood flow to the heart, which increases the stretch of the heart and in turn the contractibility of the cardiac muscles. The increase in contractility allows an increase in stroke volume or amount of blood that is expelled from the heart after each beat. This improved stroke volume allows better circulation of the blood to target organs and muscles resulting in a higher heart rate.

Repeated exposure to stress results in the body becoming more efficient in adapting to the demands put upon it by the stressor, therefore it is likely that repeated exposure to exercise will make the body more capable of coping with stressors that induce these physiological coping mechanisms (Lovallo, 2005). Previous research investigating the effects of physical activity on cardiovascular reactivity has been inconclusive. A meta-analysis of 73 studies...
by Jackson and Dishman (2006) found that cardiorespiratory fitness was associated with a slight increase in cardiovascular stress reactivity. In addition, Poole et al. (2011) found no associations between physical activity and cardiovascular reactivity in a sample of 40 women. In Traustadottir et al.’s (2005) study no difference was found in cardiovascular reactivity between 11 older-fit women and 13 age matched-unfit women. In contrast, a meta-analysis by Forcier et al. (2006) using 30 studies found a significant association between aerobic fitness and attenuated heart rate and systolic blood pressure with diastolic blood pressure trending towards significance. Dishman et al. (2003) found a significant inverse association between blood pressure and cardiorespiratory fitness among 14 female participants, but not 14 males. Contributing to confirming results, two randomized controlled trials comparing the effects aerobic training and strength training have on cardiovascular reactivity found significant associations between aerobic training and reduced heart rate reactivity (Sloan et al., 2011) as well as lower systolic blood pressure (Spalding et al., 2004). This attenuation of heart rate reactivity was also observed among 22 elite and 22 sedentary men (Rimmele et al., 2007) and among 18 elite, 50 amateur, and 24 untrained men (Rimmele et al., 2009). An aim of this study is to distinguish between these two sides of the argument and reveal whether physical activity attenuates or heightens cardiovascular reactivity and whether this is exclusive to a specific cardiovascular response (i.e. SBP, DBP, and HR). We hypothesize that there will be an attenuation of these variables among the high physical activity group, as there is more research leaning towards this side of the argument.

Research on cortisol reactivity, like cardiovascular reactivity, has inconclusive results. Out of the four studies that we know of looking at this relationship, only one found physical activity to have no effect on salivary cortisol reactivity in an all-female sample (Poole et al., 2011). The other three studies observed that people engaging in higher levels of fitness exhibited significantly lower plasma cortisol reactivity levels in older women (Traustadottir et al., 2005) and salivary cortisol in men (Rimmele et al., 2007; Rimmele et al., 2009). We hypothesize that cortisol reactivity will be lower among the high physical activity group than the low physical activity group.

Studies on cardiovascular and cortisol recovery from stress continue the trend of disagreement in findings that characterize the literature on physiological stress reactivity. Some reports have found no association between physical activity and heart rate (Rimmele et al., 2009) or blood pressure recovery (Poole et al., 2011; Sloan et al., 2011). Others have found either a lower heart rate and systolic blood pressure during recovery (Spalding et al., 2004) or a faster recovery of heart rate (Forcier et al., 2006; Jackson et al. 2006) among higher fit individuals. In contrast, there have been no significant associations found between physical activity and cortisol recovery (Poole et al., 2011; Rimmele et al., 2009). Therefore, an aim of this study is to distinguish whether there is a difference in recovery between high and low physical activity groups for cardiovascular measures (SBP, DBP, HR); however, we do not expect to see a difference in cortisol recovery.
Method

Participants

The participants used in this study were part of an earlier study looking at the effects acute stress has on physiological activity, taste perception, and food consumption (al’Absi, Nakajima, Hooker, Wittmers, & Cragin, 2012). These participants were recruited via flyers advertising the study around campus and an online recruiting system. Eligibility was assessed with a phone screening, which, if passed, allowed an invitation to be extended for an onsite health screening protocol. Exclusion criteria included being under the age of 18, taking any type of medication (exempting birth control), and having a history of any major medical or psychiatric disorder. Consent forms approved by the Institutional Review Board of the University of Minnesota were signed by all participants. After giving consent, participants were given a packet of questionnaires that included medical history, health habits. The final sample consisted of 58 participants (28 female) that completed the study.

Measures

Distress and positive affect were measured during the laboratory session using the Revised Subjective States Questionnaire (SSQ; Lundberg & Frankenhaeuser, 1980). Items such as anxiety, irritability, impatience, and restlessness were included in the Distress factor. Items such as cheerfulness, content, calmness, controllability, and interest were used to assess positive affect. All items used an 8-point scale anchored by the end points “not at all” and “very strong”. SSQ instructions directed participants to report feelings during the previous 30 minutes. Strong psychometric properties have been reported for both subscales (al’Absi, Wittmers, Erickson, Hatsukami, & Crouse, 2003).

A fitness questionnaire was used to assess amount of time participants engaged in physical activity, as well as other health habits. Questions specific to this research study included the total number of hours per week engaging in aerobic exercise and total number of hours per week engaging in anaerobic exercise. Physical activity was calculated by adding the total number of hours per week of aerobic and anaerobic exercise. Other questions on the questionnaire asked about supplement use, number of meals regularly eat per day, miles walked per week, and whether the participant was vegetarian.

A commercially available collection device was used to collect saliva samples throughout the laboratory session (Salivette, Sartstedt, Germany). Samples were stored at -70°C until data analysis. Cortisol in saliva was measured by a solid phase, enzyme-linked, immunosorbent assay kit based on competitive cortisol binding (IBL America, Minneapolis, MN). The assay range is between 0-80 ng/mL, and a minimum sensitivity of 0.54 ng/mL. Interassay coefficient of variation was < 15%, and the intra-assay coefficient of variation < 5%, as measured using an internal standard. Absorbance was determined by the Spectramax Plus (Molecular Devices, Sunnyvale, CA) microtiter plate reader at 450 nm and analyzed using Soft Max Pro software (Molecular Devices). Systolic and diastolic blood pressure (SBP, DBP) and heart rate
(HR) were measured using an automated Dynamap oscillometric blood pressure monitor (Critikon, Tampa, FL).

**Laboratory Session Procedures**

The original study this data was derived from included both a stress and rest day; however, this study only included results from the stress session, as the primary purpose of the study was to examine the extent to which reported levels of physical activity was associated with psychophysiological response to acute stress. Instructions were provided to each participant prior to the laboratory session informing them to abstain from alcohol for at least 24 h, caffeine and/or nicotine for at least 4 h, and all medications (exempting birth control) for 72 h. Participants were also instructed to abstain from strenuous exercise for at least 4 hr before the scheduled laboratory session. An hour or two before the scheduled lab session, participants were asked to eat a light, healthy breakfast (e.g. fruits and/or cereals). Consuming fatty or prepared and processed food with oil or fat was to be avoided before the lab session. Participants were asked when their last meal occurred and what it consisted of. Additionally, participants were asked to report meals for the past 24 h.

The experimenter placed a blood pressure cuff on the participant that was followed by the participant quietly watching a nature film. SBP, DBP, and HR were taken every 3 min during this time. Saliva samples were collected during baseline at the 10 min and 15 min mark. At the end of the baseline period, SSQ was completed by the participants.

After the completion of baseline, participants performed the acute stressors. Stressors included public speaking (4 min speech preparation and 4 min speech delivery), mental arithmetic (8 min), and cold pressor task (90 s). Public speaking was characterized by the experimenter reading a scenario that accuses the participant of a deed, which they needed to then defend themselves against. Participants were given 4 min to prepare their defense, which was meant to increase anxiety. The speech was then recorded and the participants were told it would be graded on a number of variables, also meant to increase anxiety. Mental arithmetic consisted of giving the participant a three digit number that they then needed to add up the individual numbers to get a new value. The resulting number needed to then be added to the original three digit number and repeated for the entire 8 min. For example, if given the number 123, the participant would have to add 1 + 2 + 3 = 6, which when added to 123 is equal to 129. The cold pressor task required the participant to hold their hand in ice cold water for the duration of the task if possible. These tasks have been described in greater detail and have been shown to effectively elicit reliable cardiovascular and adrenocortical responses in previous studies (al’Absi, Buchanan, & Lovallo, 1996; al’Absi et al., 1996). Cardiovascular measures were taken during the stress period every 2 to 3 min. SSQ and saliva were collected after the completion of the stress period.

The stress period was followed by two recovery periods. The first recovery period lasted 25 min and included a taste protocol used in the previous study (not reported here). A saliva sample was collected at the
15 and 25 min mark. Cardiovascular readings were taken during the last 10 min of the first recovery period. The second recovery period lasted 40 min and included a snack session, also used in the previous study (not reported here). Saliva was collected during the second recovery at the 30 and 40 min mark and SSQ was collected at the end of the period. Cardiovascular readings were collected during the last 10 min of the second recovery period.

Data Preparation and Analysis

The number of eligible participants after the screening session was N = 58. We looked at the frequency of total physical activity and removed two individuals who reported extreme amounts of physical activity as they were past the 95th percentile. Others excluded from analyses were 3 participants that failed to complete the stress session and 5 participants that did not complete the fitness questionnaire. Additionally, the cortisol analyses had 1 participant that was removed due to a missing sample. After the removal of these cases, we used a median split (5.5 hours) on the sample (N = 48) to create high and low physical activity groups. Physical activity was calculated by adding the total number of hours per week of aerobic and anaerobic exercise.

The primary dependent variables included HR, SBP, DBP, cortisol, positive affect, and distress. In order to test the hypothesis that physical activity would affect cardiovascular and cortisol responses, we conducted 2 (Sex: male, female) × 2 (Physical Activity Level: low, high) × 4 (Time: baseline, stress, recovery 1, recovery 2) repeated measures analysis of covariance (ANCOVA) for each dependent variable, with gender and physical activity as between-subjects factors and time as a within-subjects factor. Phase was included as a covariate as the study was conducted in two different periods that may have affected the results. Cortisol values were log transformed to meet the assumption of normality. The Greenhouse-Geisser correction was used where appropriate.

Results

Sample Characteristics

Participants’ demographic information can be reviewed in Table 1. The sample consisted of participants that were mainly college students and predominantly Caucasian. Low and high physical activity groups did not significantly differ on demographic variables. However, men and women did differ significantly on the number of years of education with men having more reported years than women (F(1,41) = 4.64, p < .05).
Table 1
Demographic Characteristics

<table>
<thead>
<tr>
<th></th>
<th>Low (n=29)</th>
<th></th>
<th>High (n=24)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>women (n=16)</td>
<td>men (n=8)</td>
<td>women (n=8)</td>
<td>men (n=16)</td>
</tr>
<tr>
<td>Age</td>
<td>19.8 (1.4)</td>
<td>24.6 (2.0)</td>
<td>20 (2.0)</td>
<td>20.5 (1.4)</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>23.3 (1.0)</td>
<td>25.1 (1.4)</td>
<td>23.7 (1.4)</td>
<td>23.2 (1.0)</td>
</tr>
<tr>
<td>Education (years)</td>
<td>14.4 (0.3)</td>
<td>15.1 (0.5)</td>
<td>14 (0.5)</td>
<td>15.1 (0.4)</td>
</tr>
<tr>
<td>Average sleep (hours/night)</td>
<td>7.5 (0.2)</td>
<td>7.5 (0.2)</td>
<td>7.5 (0.2)</td>
<td>7.3 (0.2)</td>
</tr>
<tr>
<td>Ethnicity (% of Caucasian)</td>
<td>100%</td>
<td>87.50%</td>
<td>100%</td>
<td>92.90%</td>
</tr>
<tr>
<td>Tobacco use (%)</td>
<td>6.70%</td>
<td>0%</td>
<td>0%</td>
<td>6.70%</td>
</tr>
<tr>
<td>Supplement use (%)</td>
<td>12.50%</td>
<td>12.50%</td>
<td>37.50%</td>
<td>31.30%</td>
</tr>
<tr>
<td>Vegetarian (%)</td>
<td>6.30%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
</tbody>
</table>

Note: Entries show mean (standard error) or percentage of the study sample. BMI = body mass index.

Effects of Stress

There was a significant time × sex × level of physical activity in positive affect (F(2.2,92.8) = 3.4, p < .05). Follow-up analyses comparing change scores from stress to recovery 2 found that level of physical activity × sex trended toward significance (F(1,43) = 3.9, p = .054), indicating that women in the low physical activity group may have had larger change in positive affect from stress to recovery than men of the low physical activity group and that high physical activity men may have had a greater change in positive affect than high physical activity women.

The stress protocol increased SBP (F(1.9, 81.2) = 20, p < .001), DBP (F(2.2, 96.1) = 21.74, p < .001), and HR (F(2, 86.2) = 13.68, p < .001) as shown by significant main effects of time with post-hoc comparisons (ps < .05) for each dependent variable. These main effects signify that acute stressor tasks induced significant cardiovascular responses. A significant time × level of physical activity interaction was observed for SBP (F(1.89,81.2) = 3.9, p < .05). Follow-up analyses comparing SBP change scores from baseline to stress revealed that the low physical activity group had less of a reaction to acute stress than the high physical activity group (F(1,44) = 7.4, p < .01), refer to Figure 1. The follow-up analyses look at change scores from stress to recovery showed a main effect of physical activity that trended towards significance (F(1,44) = 4.02, p = .051). The low physical activity group had a smaller mean change score, suggesting that the high physical activity group recovered faster from stress. Furthermore, men exhibited higher SBP than women (F(1,43) = 5.45, p < .05). There were no significant findings for DBP and HR. The stress protocol also increased cortisol as shown by the main time effect (F(2.45,105.5) = 3.316, p < .05). In addition, analyses on cortisol revealed a
time × gender interaction ($F(2.42, 101.8) = 3.63, p < .05$). We found a significant difference at baseline between men and women during follow-up analyses ($F(1,44) = 5.1, p < .05$), with women showing a lower cortisol level than men. The pattern characterized by lower cortisol in women than men continued immediately after the stress task ($F(1,44) = 5.9, p < .05$), as well as after the first recovery period ($F(1,44) = 10.98, p < .01$). No significant sex difference was observed during the second recovery period. Cortisol analyses showed a significant main effect for level of physical activity with the low physical activity group exhibiting a higher overall mean than the high physical activity group ($F(1,43) = 4.6, p < .05$).

![Figure 1](image)

**Figure 1.** Mean SBP measures during laboratory session.

**Discussion**

Our first hypothesis was that SBP, DBP, and HR would have an attenuated reaction to stress in the high physical activity group compared to the low physical activity group. This study found that the low physical activity group had an attenuated SBP reaction to stress. DBP and HR did not differ between groups. While it was not what we predicted, there are still previous studies that support our findings. Jackson and Dishman (2006) found that cardiorespiratory fitness was associated with a slight increase in cardiovascular stress reactivity, similar to the increase in SBP reactivity found in our sample’s high physical activity group. Our inability to find attenuation in DBP and HR was also reflected in the absence of physical activity group differences in Poole et al.’s (2011) and Traustadottir et al.’s (2005) studies. However, there are studies that are in disagreement with these findings. For example, previous studies have found lowered SBP (Forcier et al., 2006; Dishman et al., 2003; Spalding et al., 2004), DBP (Forcier et al., 2006; Dishman et al., 2003), and HR (Forcier et al., 2006; Sloan et al., 2011; Rimmle et al., 2007; Rimmle et al.,
finding was that women had lower cortisol means at baseline, immediately after stress, and during recovery 1, which may have contributed to the main effect of physical activity as there were more men included in the high physical activity group than the low physical activity group.

The final hypothesis of this study was that there would be no difference in cortisol recovery. We did not hypothesize a direction for SBP, DBP, and HR as the literature does not clearly sway towards an increase or decrease in recovery and thus needs further exploration. The findings of this study partly support our third hypothesis as we did not observe a significant time × level of physical activity interaction in cortisol recovery. The lack of difference between high and low physical activity groups in cortisol recovery has also been observed by both Poole et al. (2011) and Rimmlele et al. (2009). We also found a trend towards significance for a level of physical activity group difference for SBP in recovery, with the high physical activity group having a larger change score from stress to recovery than the low physical activity group. This suggests that high physical activity individuals recovered faster, constrasts the findings of Spalding et al.’s (2004) study, which found attenuation during recovery among the high physical activity group. There was also no difference in DBP and HR recovery between high and low physical activity groups, which supports some of the previous literature (Poole et al., 2011; Rimmlele et al., 2009; Sloan et al., 2011), but contradicts others (Forcier et al., 2006; Jackson et al., 2006; Spalding et al., 2004).

Secondary findings not directly related to our hypothesis involved some sex
differences. A significant main effect of sex revealed that men had a higher overall SBP mean than women. This finding furthers the already well-established literature on sex differences in cardiovascular functioning (Childs, Dlugos, & De Wit, 2010; Matthews, Gump, & Owens, 2001; Steptoe, Fieldman, Evans, & Perry, 1996). Similarly, we found a sex difference for cortisol with women showing a lower mean cortisol than men at baseline, immediately after stress, and during the first recovery period. This is consistent with previous research findings that observed a higher HPA axis reactivity in men than women (Kajantie et al., 2006; Kudielka et al., 2005). However, there are studies that observed similar cortisol reactivity in men and women when women were tested in the luteal menstrual phase (Kirschbaum et al., 1999; Rohleder et al., 2001; Walder et al., 2012; Wolf et al., 2001). It seems that testing women in the follicular phase or women using oral contraceptives results in the blunting of the cortisol response (Kirschbaum et al., 1999; Kirschbaum et al., 1995; Rohleder et al., 2003; Tersman et al., 1991; Walder et al., 2012).

Limitations

This study was limited by our small sample size, which did not allow for an even spread of males and females in each physical activity group possibly affecting the results we obtained. Another limitation was the homogeneity of the sample, which consisted of relatively similar participants in terms of age, BMI, and racial background. When comparing this study to previous studies on physical activity, the use of a subjective fitness questionnaire may be a limitation as objective measures could prove to have more ecological validity. Despite the limitations, this study had several strengths such as the reliable inducement of physiological stress and several assessment measures (i.e. cardiovascular and hormonal).

Conclusion

In summary, this study has added to the available knowledge regarding physical activity’s effects on cardiovascular and cortisol reactivity and recovery among healthy young adults. We have provided evidence that higher physical activity may increase SBP reactivity to acute stress, as well as speed the time to recovery as compared to the low physical activity group. Evidence is also provided for the low physical activity groups to exhibit a higher overall cortisol mean as compared to the high physical activity group. These results have implications for the study of how physical activity affects physiological reactivity and recovery in the context of how it possibly prevents cardiovascular diseases.
References


The Potential Decrease in Learning Due to Competition for Attention

Noel R. Reynolds, Psychology / Sociology
University of Minnesota Duluth
Robert L. Lloyd, Ph.D., Mentor
University of Minnesota - Duluth
Department of Psychology

Abstract

Who hasn’t endured the unfortunate occurrence of being in close proximity to an individual who is emitting a strong odor of perfume or cologne? Trapped in classrooms by necessity of attendance, students are exposed to odorants in the form of perfumes and colognes that not only compete for attention resources, but reduce the efficacy of the students ability to perform cognitive tasks in addition to the increased potential adverse health effects. In 1991, Tyler S. Lorig conducted research into the interactions between odorants and execution of cognitive tasks. Establishing that odorants, even those below a conscious level of detection, had significant correlation to the degree of response competition as demonstrated by the positively correlated increase in the P200 wave and the concentration of the odorant, attenuation is greatly influenced by olfaction. (Lorig et al, 1991) In this study, we use cognitive task performance accuracy and response times in a Stroop Test to demonstrate any effects odorants have in the classroom: specifically, a decrease in response times while performing the task. While cited as a measurement tool of unconscious insight (Wade, 2012), the purpose of employing the Stroop Test herein is solely applied to examine time delays.

Keywords: Response competition, odorant, smell, olfaction, Stroop Effect, cognition, perfume, cologne, classroom, learning

Introduction

No research is conducted without inspiration or function. This study is no different. Due to the alarming number of people who insist on wearing an exaggerated, and potentially lethal amount of fragrance, classrooms have been dubbed as “toxic environments” by many researchers. Located in Seattle, Washington, several professors have banded together to teach a course entitled “Choices that can kill: Ethics, the Environment, and Human Health”. The students are given a strict fragrance policy which bans all fragranced products from the classroom. More so, the North Seattle Community College has placed restrictions on the entire campus, as cited in this syllabus excerpt from the afore mentioned class:

This problem is not yet widely recognized as a serious health issue, and as a result people do not realize that by using or wearing something with artificial fragrance in it, they may be jeopardizing someone else’s physical health. NSCC now has an official Indoor Air Quality (IAQ) policy which specifically urges that people refrain from wearing fragrances or scented products anywhere on campus or in classrooms.
(If you wish to see this IAQ policy, see the NSCC website or ask for a copy at any college office.)

Colognes, perfumes, aftershaves, scented hand lotions, and scented hair sprays usually cause people the most distress. We are asking, and the NSCC IAQ policy asks, that you please avoid using these products on the days you come to campus. This will benefit you (since these solvents and neurotoxic chemicals are harmful to all of us, even if we do not immediately notice their effects), and it will especially benefit those sensitized persons, some of whom may be saved severe suffering, sometimes including migraines and serious asthma attacks. (Hostetler, Kearns, Saunders, 2004)

In order to examine the need for such aggressive classroom policies, this study was designed to measure the effects of odorants on the concentration and performance on cognitive tasks while exposed to an odorant. The previous related studies examined the effects on cognition and/or response competition, but not attenuation modulated by agreeableness. That is to say, does exposure to a pleasant odor cause less distraction than an unpleasant odor?

Attenuation

Established in 1958 by Donald Broadbent, the theory of “one channel” attention capability through the use of dichotic listening and shadowing experiments demonstrated how the subjects were only able to attend to one sensory input at any one given time. The “buffer” as it was referred to by Broadbent, decides which sensory input to attend based on physical its characteristics. Other factors such as semantic the meaning of the input was determined only after passing through the buffer. (Figure 1) Although not directly related to the Lorig study, Broadbent established the concept of finite attention. (Broadbent, 1958) Therefore, it is reasonable to conclude the learning efficacy decreases when there is an odorant competing for the single channel. The afore mentioned Lorig study did just that, concluding that odorants do have influences on the subjects ability learn and respond. Using these conclusions as accepted assumptions, the exposure to odorants, in the form of perfumes, colognes, and air fresheners, will have negative effects on the ability of college students to learn in a classroom where the levels of the odorant is above and below detection levels. The necessity of providing a learning environment with the lowest possible level of odorants regardless of the odorants degree of pleasantness will be demonstrated by this study. For this study, the odorants employed were white vinegar, peppermint extract, and bottled water.

Perfumes and Fragrances are Harmless, Right?

In response to the ever-growing collective of research into fragrances and their effects on health and learning, many teachers and professors are asking students to reduce or forego fragrances in their classrooms. Examples of this can be found in the Greenville, South Carolina School District (K-12) and University of California Stanislaus. What is important not to get lost in all the science of response competition is this: the allowing of odorants in the classroom not only lends to deficits in cognition and attention, but may very well pose serious
health risks to the bearers of said odorants and those around them.

Continuing since the 1980’s, an alarming trend has emerged in the personal odorant industry. The National Academy of Sciences has declared that 95% of fragrances are now synthetic in composition, many containing petroleum derivatives, and compounds resulting from chemical reactions. (Pitts, 2003) According to Pitts, there is a list of chemicals frequently found in fragrances that are also found on the EPA’s Hazardous Waste List, containing but not limited to: “numerous carcinogenic chemicals, neurotoxins, respiratory irritants, solvents, aldehydes, hundreds of untested and unregulated petro-chemicals, phthalates (which can act as hormone disrupters), narcotics, and much more.” Conducted by the EPA in 1992, a study entitled “Polar Organic Compounds in Fragrances of Consumer Products” found the following compounds in popular fragranced consumer products: “ethanol, camphene, Beta-pinene, Beta-myrcene, benzaldehyde, limonene, benzyl alcohol, Beta-phenethyl alcohol, citronellal, camphor, benzyl acetate, estragole, Alpha-cedrene, Alpa-pinene, diethylene glycol monomethyl ether, linalool, Alpha-terpineol, Beta-citronellol. Other compounds identified were: acetone, t-butanol, ethyl acetate, toluene, 3-octanone, cineole, 2-ethyl-1-hexanone, phenylacetaidehyde, terpinen-4-ol, and menthyl acetate.” (Dewey, 2010) The list of possible side-effects of exposure to these chemical compounds is too many to list here. Let this suffice: in order to be polite, please give a Material Safety Data Sheet (MSDS) along with the next gift of bubble bath or perfume you decide to give for a birthday or other special event.

The Competition for Limited Response Resources

Consider this scenario: You are at the airport waiting in the line for the TSA security check. Naturally you are not alone, far from it. There are several lines, but only one check point. This is the Broadbent Theory. No matter how many people are in line (in this case, how much sensory input is taken in by the brain), there is only one check point through all must pass (the channel of selective attention). Human attention, singular in its intent, must process one “piece” of information before it can process another, there is no multitasking. At this point it is important to note that the brain is taking in and working with massive amounts of information at any given time. However, by means of Broadbent’s Theory, we only are able to make one decision at a time when consideration and decision are needed (much like the security checkpoint, only one individual can pass at a time due to the attention that must be afforded the question of security), only one decision can be afforded the brains conscious attention. (Figure 1) (Broadbent, 1958) Therefore, any process that requires a decision or clarification requires the brain to slow down and focus attention on the task. This slowing down of task performance due to response competition (or competition for attention resources) is the connection between Broadbent and Stroop for the purposes of this study.
There is one additional concept that needs to be considered in order to put Broadbent’s single channel concept in perspective: attenuation. In 1964, Anne Treisman offered a new perspective on dichotic information, posing a new model of attenuation in regards to information prioritizing. More precisely, the Treisman Model does not point to a extinguishing of dichotic information, but an attenuation of the input. That is, the “intensity” of the dichotic input will be attenuated to a level which is below decision level, but above detection level. In this model, both inputs are attended to, simply, one is prioritized while the other input is processed, but in the background. (MacLeod, 2008)

**The Stroop Effect as a Measure of Response Competition**

The Stroop Effect, named after its researcher John Ridley Stroop, demonstrates that words have more intrinsic value than the face value assumed. In the experiment that established this concept, employed the spelled word of colors, but spelled out in a color of font that didn’t match the words meaning. (Figure 2) This is the key for establishing that the concept of a “word” is multi-faceted. That is, the word itself has a shape, color, size, and semantic meaning. To that point, whenever any one of those elements are out of the ordinary or unexpected, the brain must refocus attention to the word being considered in order to comprehend its elements and context, regardless of the need for a decision or action, or neither. Please note the modified Stroop Test (figure 3); this test would not elicit a Stroop Effect. In other words, there would be no attention-resource competition because there is a congruency between word and color of font. Think of incongruency between font color and semantic meaning as a “mental speed bump” of sorts, requiring that we slow down and make a concerted choice of the words meaning. (Bower, 1992) The most effective method to highlight the importance of the semantic meaning is to remove the meaning all
together. In a paper discussing the “Reverse Stroop Effect”, Durgin conducts a protocol where the words are replaced by patches of color. The delay in identification of the patches is diminished due to the removal of all semantic meaning. (Durgin, 2012)

Although Stroop is given credit for the concept of delayed decision response, and certainly was the driving force behind the concept, there had previously been relevant observations some 50 years previously in the Wundt laboratory (described in a 1886 doctoral dissertation by James McKeen Cattell) in which there are observations denoting longer periods of time were required to say a color word not written in the same colored font. (MacLeod, 1991)

(Figure 2, The Stroop Effect Test, incongruent)

<table>
<thead>
<tr>
<th>Red (Blue)</th>
<th>Blue (Red)</th>
<th>Yellow (Green)</th>
<th>Green (Yellow)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blue (Green)</td>
<td>Green (Yellow)</td>
<td>Yellow (Green)</td>
<td>Red (Blue)</td>
</tr>
<tr>
<td>Green (Red)</td>
<td>Red (Blue)</td>
<td>Blue (Yellow)</td>
<td>Green (Blue)</td>
</tr>
<tr>
<td>Red (Yellow)</td>
<td>Yellow (Red)</td>
<td>Red (Green)</td>
<td>Green (Blue)</td>
</tr>
<tr>
<td>Green (Blue)</td>
<td>Blue (Red)</td>
<td>Blue (Yellow)</td>
<td>Yellow (Green)</td>
</tr>
<tr>
<td>Blue (Red)</td>
<td>Green (Blue)</td>
<td>Red (Yellow)</td>
<td>Red (Red)</td>
</tr>
<tr>
<td>Red (Green)</td>
<td>Blue (Red)</td>
<td>Blue (Blue)</td>
<td>Yellow (Blue)</td>
</tr>
</tbody>
</table>

Methods

Sample: The sample size utilized was 25 subjects (n=25), consisting of students attending the University of Minnesota Duluth. The recruitment was conducted by utilizing the University of Minnesota Duluth’s SONA website, the Psychology Department’s online research study sign-up system. There were no age or gender restrictions for participation. However, students with a history of hypersensitivity to allergens or odorants, or possessing a medical history of respiratory compromise,
will not be qualified to participate due to the danger of respiratory and exposure dangers. The student participants were given class credit for volunteering to participate in the study.

**Location:** The research was conducted in the University of Minnesota Duluth, Department of Psychology Labs. Subjects were seated at a desk along the perimeter of the room, facing outward so as not to have the ability to observe or influence other subjects. Included on the desktop were a computer monitor, keyboard, instruction sheet, consent form, and a three ounce (3 oz.) container containing a clear fluid, covered and placed on a taped “X” on the surface of the desk, located in front of the subject’s position.

**Data collection:** Each subject was seated in their test location and instructed to face forward and open the container of liquid, placing back onto the “X”. Following the opening of the container, subjects were instructed to read the consent form, ask any questions, and read the instruction sheet. There was a five minute time-frame given to accomplish the reading and accepting of the consent form. This time frame was established to complete the paperwork, but also to allow for a five minute exposure to the odorant, or an absence of an odorant in context to the control group. Subjects were then instructed to perform a computerized version of the afore mentioned Stroop Test already set-up on the computer at their workstation. This test will be administered three times on three different occasions, each with a different odorant, or absence of. Please note that the possibility of odorant cross contamination was controlled for by employing different containers for each subject, and for every exposure. The possible confound of carry-over effect was controlled for by conducting the research in a well ventilated room, allowing for a minimum of two full days (48 hours) between exposures to ensure that no remnants of prior odorants remained. The three exposures were as follows:
- Vinegar (Household consumer concentration)
- Bottled drinking water
- Water with peppermint extract (1 tablespoon in 3 ounces of water)

The software being employed provides the percentage of correct answers and response times for the test. The test can be viewed and executed by entering the following address into your web browser: http://www.onlinestrooptest.com/stroop_effect_test.php

**Analysis:** The analysis of data was performed by the use of SPSS 20 software, setting the alpha level alpha (p< 0.05) while employing a 3x2 ANOVA to examine the relationships between the three odorants (V, W, P) and the two stimuli (congruent and incongruent tasks).

**Results:** The first task was to ensure the presence of the Stroop Effect. That is, is there a significant difference in the mean response times during the cognitive task to establish a “time delay” needed to process the meaning of a color word when it is written in an incongruent color? The data collected during the Stroop Test was categorized into three separate subsets, each with its own variable, congruent or incongruent: water set (CW, IC), peppermint set (CP, IP), and vinegar set (CV, IV). In this case, there was a consistent difference in the amount of time needed to respond to each of the word sets:
congruent \( (m=15.606, \text{SD}=0.840) \), and incongruent \( (m=22.583, \text{SD}=1.183) \) This resulting delay establishes the presence of the Stroop Effect, and will later demonstrate that all odorants do not affect this phenomenon the same. (Figure 4)

![Estimated Marginal Means of MEASURE_1](image)

(Figure 4, mean response times to the Stroop Test)

The second point to examine, and most pivotal point to establish, is the difference between the delays in response times due to response competition, which can be attributed to each of the odorants employed. The data clearly shows a significant difference in the cognitive functioning of the subjects while exposed to different odorants. The pair wise comparisons of each variable pair demonstrated a significant change in response times: vinegar/water paradigm \( (p=0.001) \), where as the peppermint/vinegar paradigm \( (p=0.006) \) both clearly show a difference in the degree in which an odorant can effect response times and cognitive efficacy. Additionally, both peppermint and vinegar both caused deficits when compared to water.

**Discussion:** Yes, I found statistical significance, and yes, I found what I was looking for. However, none of that matters if it doesn’t translate into action. The question at hand is simple: to what degree of odorants in the classroom are acceptable? This study demonstrates that odorants do have real effects on a subjects’ ability to concentrate, in some cases, to the extent in which performance efficacy displays marked changes.

**Conclusions:** The conclusion to be drawn from this study is straight forward. Odorants in the classroom, offensive or pleasant, distract the students from the task at hand, learning. To that end, it is clear that a real need exists to restrict the level of colognes and perfumes in the
classroom. This conclusion also brings into question, personal hygiene. If an odorant, good or bad, can distract from learning, then certainly a degree of personal hygiene should be expected for those who occupy common spaces with others. That is to say, the odor associated with poor personal hygiene is equally inappropriate when it reaches a level of distraction, just the same as perfumes or colognes. Standards are needed, and this study demonstrates the degree to which they are warranted as well.
References


Quantification of myofilament and sacroplasmic reticulum proteins in transgenic mice overexpressing Ribonucleotide Reductase*

Stephanie A. Simek, Exercise Physiology
The College of St. Scholastica
Michael Regnier, PhD, Mentor
Sarah Nowakowski, Graduate Student, Mentor
Jacqueline Robinson-Hamm, Zhaoxiong Luo
Department of Bioengineering
University of Washington - Seattle

*The approach to enhance cardiac muscle performance described in this paper is patent protected and has been licenced by BEAT Biotherapeutics Corporation (see Disclosure).

Abstract
Heart disease is the leading cause of death in the developed world. In order to improve whole heart function following heart attack, the Heart and Muscle Mechanics (HAMM) lab is evaluating a novel gene therapy approach to increase healthy cardiomyocyte contractility by increasing the expression of ribonucleotide reductase (RR) in the heart. RR is responsible for removing oxygen from the 2’ hydroxyl group of the ribose in ATP, creating 2-deoxy-ATP (dATP). Previous studies have demonstrated that when myosin uses dATP as a substrate for muscle contraction instead of ATP, there is an increase in contractility. In order to better understand the effects of elevated [dATP], the HAMM lab has been studying a transgenic mouse model of RR overexpression in addition to developing the gene therapy described above. Concomitant to the studies described here, functional assessments have been carried out on these animals that indicate they have increased cardiac systolic pump function and cardiomyocytes have increased magnitude and rate of shortening relative to control animals. This study is focused on using western blot analysis to assess regulatory protein expression and phosphorylation levels to determine if elevated [dATP] results in alterations to myofilament protein expression or phosphorylation. It was hypothesized that there would be no change in protein expression but that phosphorylation of myofilament proteins may differ between TgWT and TgRR mice. Western blots were performed using glyceraldehyde 3-phosphate dehydrogenase (GAPDH) as an internal control and then quantified using ImageJ. Analysis of the results is ongoing.

Introduction
Heart disease is the leading cause of death in the developed world [1]. According to the World Health Organization (2011), 17.3 million people died of cardiovascular diseases in 2008 and this number is only expected to increase in the coming years. In 2030 an estimate of 23.6 million people will die from cardiovascular disease [2].

Heart disease is especially threatening because cardiac muscle cells (cardiomyocytes) cannot regenerate themselves. Thus, when a person suffers a heart attack, a portion of the heart dies (undergoes necrosis) and becomes non-functional scar tissue that will not return to
contractile muscle tissue on its own. Scar tissue is unable to contract, therefore following an infarct, the whole organ function is decreased. Contractility is lost completely in the area of injury, which decreases the heart’s overall ability to contract. Our goal is to increase contractility of the surviving cardiomyocytes, in order to restore the function of the damaged heart. Muscle contraction is initiated by an action potential, which creates a wave of depolarization that causes an influx of calcium to enter the cell. The sarcoplasmic reticulum (SR) stores intracellular calcium that is released upon depolarization in a process called calcium induced calcium release (CICR). This release of calcium from the SR initiates contraction by binding to the myofilament protein, Troponin C (TnC). In the absence of calcium, TnC does not interact strongly with Troponin I (TnI), and thus TnI instead binds to actin (the primary component of the thin filament), preventing myosin from binding. When calcium binds to TnC, however, there is increased interaction between TnC and TnI that effectively opens myosin binding sites on actin [3]. Once myosin has hydrolyzed ATP to ADP.Pi and binds to actin, muscle contraction occurs. Myosin converts the chemical energy from hydrolysis into mechanical energy when it undergoes the powerstroke, which results in either shortening (unloaded) or force (loaded). Ultimately, calcium is pumped back into the SR by a regulatory protein called Sarco(endo)plasmic reticulum Ca++ATPase (SERCA2a), which causes the muscle to relax [4]. SERCA2a is regulated by a protein called Phospholamban (PLN) that inhibits calcium from being pumped when dephosphorylated [4].

Previously, the HAMM lab has shown that cardiac contractility is improved by using 2-deoxy-ATP (dATP) as a substrate for cardiac muscle contraction instead of ATP [5]. Since the enzyme ribonucleotide reductase (RR) is responsible for turning ATP into dATP, overexpression of RR elevates cellular [dATP] [6]. Therefore, overexpression of RR can be used as a tool to improve contractility in cardiomyocytes. The HAMM lab has observed that contractility is increased without using more calcium, indicating that the elevated [dATP] primarily affects the myofilament.

In order to characterize the effects of chronic elevation of RR on cardiac function, transgenic mice that overexpressed RR were used in this study. These mice demonstrated enhanced cardiac function at both the whole heart and single cell level. There were two primary goals to the study presented below: (1) To investigate whether these functional alterations were a result of changes in regulatory protein expression and phosphorylation, and (2) to determine whether there were compensatory changes to regulatory protein expression or phosphorylation. In order to achieve these goals, we analyzed TnI, PLN, and SERCA2a using Western Blot techniques.

Since PKA-mediated phosphorylation of myofilament and SR proteins during beta adrenergic stimulation can have similar effects on cardiac function as dATP (e.g. increased rate and magnitude of shortening), we hypothesized that we would observe an increase in TnI phosphorylation in TgRR mice. Since there were no alterations to calcium handling observed between TgRR and TgWT mice, we did not expect to observe any changes
to the expression or phosphorylation of the sarcoplasmic reticulum proteins.

**Methods**
Cardiac tissue samples were obtained from both TgRR and TgWT mice. Samples were tested for regulatory proteins via western blotting to assess the expression of regulatory proteins in cardiac tissue. Antibodies were used to probe for total TnI expression as well as specifically for phosphorylated TnI, SERCA2a, PLN, and phosphorylated PLN at either Ser16 (PLN Ser16), or Thr17 (PLN Thr17). Glyceraldehyde 3-phosphate dehydrogenase (GAPDH) was used as an internal control. Image J [8] was used to quantify densities of the protein bands (Figure 1). Thicker bands represented a higher expression of protein.

**Results**
At the time of this study, no significant differences in myofilament protein expression had been found, which supports our hypothesis. Interestingly, a reduction in TnI phosphorylation levels in RR mice was observed. Since we would expect a decrease in phosphorylation of TnI to result in reduced contractility, we hypothesize that this reduction in TnI phosphorylation is actually a compensatory change in the transgenic animals. These data could partially explain the fact that the increase in contraction observed in the transgenic mice was lower in magnitude than that observed in a previous acute viral study [7].

![Western Blot](Image)

**Figure 1.** Image J analysis of TnI protein bands.

![Bar Graph](Image)

**Figure 2:** (Top) Western Blot comparisons of myofilament proteins (TnI, Phosphorylated TnI) to GAPDH. (Bottom) Bar graph comparisons of treatment and control groups.

There were no significant changes observed in sarcoplasmic reticulum protein expression and phosphorylation. This supports our hypothesis and suggests that the primary effect of dATP is on the
myofilament, not on calcium handling proteins.

phosphorylation profiles of the SR proteins. However, we did observe a reduction in the amount of TnI phosphorylation in TgRR mice. We hypothesize that this is a compensatory response observed in these animals, which have had increased contractile demands since birth as a result of the elevated [dATP]. It is possible that the basal level of myofilament phosphorylation is altered in these animals in order to reduce the demands of the increased contractile performance.

**Future Work**
Further assessment of myofilament and sarcoplasmic reticulum proteins are currently being carried out in more transgenic mice. Additionally, to assess the hypothesis that the basal level of phosphorylation may be altered in these mice as a compensatory change, we are also quantifying the phosphorylation of Myosin Binding Protein C, another regulatory protein associated with the myofilament that can be phosphorylated by PKA. Cellular cAMP levels are also being assessed using an ELISA assay in order to better understand the activity of PKA in these animals.

**Disclosure**
Dr. Michael Regnier holds a provisional patent and has filed an international patent application (#45511.02WO2) to treat heart failure via RR overexpression. This technology has been licensed to BEAT Biotherapeutics Corporation, of which Dr. Regnier is a co-founder.

**Figure 3:** (Top) Western Blot comparisons of sarcoplasmic reticulum proteins (SERCA2a, PLN, PLN Ser16, PLN Thr17) to GAPDH. (Bottom) Bar graph comparisons of treatment and control groups.

**Conclusions**
As we expected, there were no significant differences in myofilament and sarcoplasmic reticulum protein expression, nor was there any difference in the
Acknowledgements

I would like to thank Dr. Michael Regnier, Sarah Nowakowski, Jacqueline Robinson-Hamm and Zhaoxiong Luo for training and mentoring me throughout my research project. Also, thank you to the rest of the HAMM lab for all of their support and guidance. I would especially like to thank Sarah Nowakowski and Mary Butler for editing my paper. In addition, thank you to the members of the Ronald E. McNair Post-baccalaureate Achievement Program at The College of St. Scholastica for preparing me for a summer research program. This research was supported by the Amgen Foundation as part of the UW Amgen Scholars Program.

References


Furfural: A Platform Molecule for Quality Chemicals

Kendra D. Souther, Chemistry / Biochemistry
The College of St. Scholastica
Elif Gurbuz, B.S. and James Dumesic, Ph.D.
Department of Chemical and Biological Engineering
University of Wisconsin - Madison

Abstract

There has been current interest in using biomass to replace crude-oil based products to unlock valuable sugars found in lignocellulose to create a molecule for further conversion to quality chemicals and fuels. Xylose can be dehydrated to create furfural. During conversion of xylose undesired products are created lowering the yield of furfural. Different solvents and solid acid catalysts were studied to determine which combination limited side reactions and allowed for the highest yield of furfural. It was found that side products from xylose are more reactive and prone to coupling with furfural when pure water is used as a solvent. The combination of H-Mordenite as a solid acid catalyst and GVL as a solvent limits the side reactions created during dehydration of xylose and maximizes the yield of furfural with 81%.

Introduction

A possible route for using biomass to replace crude-oil based products is to unlock valuable sugars found in lignocellulose to create a molecule for further conversion to value added fuels and chemicals. One sugar that has the ability to be converted into such a molecule is xylose. Xylose can undergo a dehydration reaction to produce furfural. Furfural is a molecule that by itself can be used in the production of adhesives and resins. Also being known as a platform molecule, furfural’s derivatives can be processed to create value added chemicals and fuels. Below is a schema of different biofuel components that can be produced from furfural derivatives. Unfortunately, there is a current problem in the dehydration of xylose to furfural.

Figure 1. Furfural platform for biofuels[1]
During the conversion of xylose to furfural undesired side products are created lowering the yield of furfural. Current production of furfural happens in a monophasic system with a homogeneous catalyst, which suggests that the issue could lie within the catalyst being used. To find a solution to this problem, different solvents and solid acid catalysts will be studied to determine which combination limits side reactions and allows for the highest yield of furfural. In moving forward with finding a solvent and solid acid catalyst combination that limits side reactions and maximizes the yield of furfural, past studies gave rise to which solvent could alleviate the current problem.

Past studies have shown that γ-valerolactone (GVL) is attractive as a solvent for many reasons. GVL is first attractive as a solvent because it is considered a green solvent in the fact that it can be produced from lignocellulose[2]. Another reason why there are many positives to using GVL is that GVL can also be synthesized from furfural, eliminating the need for product purification. With this knowledge of what solvent to use in the production of furfural, additional studies were done to study what effects degradation and production of furfural.

**Objective**

Optimize the production of furfural from dehydration of xylose by identifying a solid acid catalyst that limits the side reactions and maximizes the yield of furfural.

**Methods**

**Figure 2.** Glass reactor and hot oil bath.

Reaction Conditions:

- Hot oil bath at 175° C
- Stirred at 1050 rpm

Detection and quantification of products done by High Performance Liquid Chromatography (HPLC)

**Results and Discussion**

To begin these additional studies, the task of finding a solid acid catalyst that produced high yields of furfural was the first goal.

**Figure 3.** Maximum furfural yield achieved using GVL as the solvent

Figure 3 above shows the maximum furfural yield attained using a 2wt% xylose feed in a GVL solvent. Catalysts were chosen based on the Lewis/Bronsted acidity contained...
within each catalyst. Catalysts that contained only Lewis acid sites, γ-alumina and Sn-SBA-15, resulted in the lowest yields of furfural, 5% and 40% respectively. For catalysts that did contain some Bronsted acidity, high yields of furfural were able to be achieved, i.e. Amberlyst 70 and H-Mordenite. Moreover, H-Mordenite gave the best yield for furfural with 80% due to its zeolite structure. Zeolites are not only of interest as a solid acid catalyst because they are low in cost and have the possibility for regeneration, but also because they can be highly selective due to their shape\(^3\). Further studies were done using H-Mordenite and Amberlyst 70 in the presence of different solvents. Since xylose is obtained from aqueous solutions through various hemicellulose solubilization strategies, it is probable that water will be present in the xylose feed streams from biomass resources\(^4\). With this being known, a past study was done using various concentrations of water in the solvent GVL with H-Mordenite as the catalyst. It was found that furfural production decreased with water concentration higher than 10%\(^5\). To determine how water affects the formation of furfural and whether or not H-mordenite plays a part, reactions were done to monitor the formation and degradation of furfural in pure water as a solvent as well as the GVL solvent (containing 10 wt% water) over H-Mordenite.

![Figure 4. A) Furfural yield achieved starting from 2wt% xylose feed and furfural concentration starting from 1wt% furfural feed in GVL solvent containing 10wt% water with time. B) Furfural yield achieved starting from 2wt% xylose feed and furfural concentration starting from 1wt% furfural feed in water with time.](image-url)

In Figure 4A, furfural yields achieved with a 2wt% xylose in solvent GVL containing 10wt% water were shown. Within the same graph, a separate experiment containing results of furfural concentration over time with 1wt% furfural in solvent GVL containing 10wt% water were shown. Figure 4B are the same experiments when the solvent was switched to pure water. Furfural yield was found to be higher in GVL solvent for both catalysts then when pure water was used. Degradation of furfural was also more prominent in water for both catalysts. Undesirable degradation reactions that furfural can undergo include...
fragmentation, resinification, and condensation.

Fragmentation occurs when furfural can be split to create smaller molecules. In a resinification reaction, a furfural molecule reacts with another furfural molecule. Condensation reactions take place between furfural and pentose molecules or intermediates, (in this case xylose). In the experiments from Figure 4 containing 1wt% furfural, without the presence of xylose and xylose intermediates, degradation was attributed to fragmentation and resinification reactions only. While degradation rates for both catalysts are similar, Amberlyst 70 gave significantly lower yields in the presence of pure water. This trend suggests that furfural degradation, as it is being formed from xylose, are not only fragmentation and resinification reactions, but could also take place by condensation reactions between furfural and side products created from xylose. Further experiments were conducted to understand the importance of furfural condensation reactions.

The large difference in the extent of furfural degradation for H-Mordenite and Amberlyst 70 in the presence of xylose and water suggests that furfural condensation with side products from xylose becomes more
prominent in pure water, mainly over Amberlyst 70. With looking at the effects of water, this study suggests that side products created from xylose are more reactive in the presence of water and therefore more prone to coupling with furfural. It’s important to mention that in both experiments, H-Mordenite gave higher yields of furfural than Amberlyst 70 due to its shape selectivity.

**Conclusion**

It was found that in the optimization of furfural production GVL works best as a solvent with H-Mordenite as the solid acid catalyst to give the maximum yield of furfural at 81%. H-Mordenite worked best as a catalyst due to the catalyst being a zeolite which contains pores of a limited size. With limited pores, it hinders the creation of bulky high molecular weight products that could stem from condensation reactions between furfural and side products of xylose. When pure water is used as a solvent, xylose intermediates are more reactive leading to increased condensation reactions. This new found production method for furfural can be used in pulp and paper mills to create value added chemicals from hemicellulose waste stream.

**References**


Role of the Adenine Nucleotide Transporter in Cancer Cells

Joseph F. Vuicich, Biology
The College of St. Scholastica
Eduardo Maldonado, PhD; David DeHart; and John J. Lemasters, PhD
The Medical University of South Carolina

ABSTRACT

Background: Cancer cell metabolism is characterized by enhanced glycolysis and suppression of mitochondrial metabolism (Warburg phenomenon). Carboxyatractyloside (CATR) and bongkrekic acid (BKA) specifically inhibit the adenine nucleotide transporter (ANT), whereas oligomycin (Oligo) inhibits the mitochondrial ATP synthase. The aim of this project is to assess whether ANT is the main transporter involved in mitochondrial ATP translocation in cancer cells exhibiting the features of Warburg metabolism. Methods: Cellular respiration and extracellular acidification rates (ECAR) in HepG2 and A549 cells were assessed using a Seahorse XF24 Analyzer. Mitochondrial membrane potential (ΔΨ) was assessed by fluorescence of tetramethylrhodamine methyl ester (TMRM) using confocal microscopy.

Results: Myxothiazol (Myxo) (10 μM), an inhibitor of complex III of the respiratory chain and Oligo (10 μg/mL) inhibited respiration by 50% and 60% respectively in HepG2 and A549 cells. Sequential addition of Myxo and Oligo collapsed ΔΨ indicating that ΔΨ was sustained by respiration and ATP hydrolysis. Myxo also increased ECAR consistent with an enhancement of glycolysis after respiratory inhibition. Unexpectedly BKA and CATR alone did not decrease respiration or increase ECAR in A549 and HepG2 cells. Both BKA and CATR also failed to collapse ΔΨ after Myxo treatment indicating that the flux of ATP into mitochondria was not blocked and that ATP hydrolysis was sustaining ΔΨ. In addition, Oligo after either BKA or CATR decreased respiration, increased ECAR, and collapsed ΔΨ confirming that both BKA and CATR were not inhibiting ATP translocation. Conclusion: Cancer cells maintain ΔΨ through respiration and ATP hydrolysis as determined by Oligomycin-induced collapse of ΔΨ after Myxo. By contrast BKA and CATR failed to inhibit ATP translocation into mitochondria after respiratory inhibition indicating that ANT is not the main transporter involved in the ATP turnover in cancer cells.

INTRODUCTION

Enhanced aerobic glycolysis and suppression of mitochondrial metabolism were described as features of the energetic metabolism of cancer cells by Warburg in the 1920s (Warburg et al., 1927; Warburg, 1956). Non-proliferating tissues under aerobic conditions generate about 5% of cellular ATP through glycolysis and the remainder by mitochondrial oxidative phosphorylation. In cancer cells, however, glycolysis accounts for 50 to 70% of ATP production even at physiological concentrations of oxygen (Gambhir, 2002). Although Warburg suggested that respiration by cancer cells is damaged, isolated tumor mitochondria are actually fully functional with regards to respiration.
and ATP synthesis (Nakashima et al., 1984). Moreover, mitochondria of cancer cells maintain $\Delta \Psi$ though respiration and ATP hydrolysis as predicted by chemiosmotic theory (Maldonado et al., 2010). Thus, suppression of mitochondrial metabolism in tumor cells is not a deficit of mitochondrial function but rather a physiological adaptation that remains incompletely understood.

Both in cancer and in primary cells, respiratory substrates, phosphate, and ADP enter mitochondria through the voltage dependent anion channel (VDAC) located in the mitochondrial outer membrane (Maldonado et al., 2012). The different respiratory substrates, phosphate and ADP then enter the matrix through specific transporters located in the mitochondrial inner membrane. The adenine nucleotide translocator (ANT) comprising 4 isoforms in humans exchange ADP and ATP between the mitochondrial matrix and the mitochondrial intermembrane space in a one to one molar ratio. In cancer cells, that overexpress ANT2, the transporter is believed also to allow the import of cytosolic glycolytic ATP into mitochondria.

In this paper we studied the contribution of ANT to ATP translocation and mitochondrial metabolism in cancer cells. We showed that mitochondria from proliferating cells can maintain mitochondrial membrane potential ($\Delta \Psi$) and respiration after ANT inhibition indicating that ANT is not the main transporter of ATP in cancer cells.

**MATERIALS AND METHODS:**

**Cell Culture:** in HepG2 human liver carcinoma cells and A549 human lung carcinoma cells were grown in Eagle's minimum essential medium (EMEM) and F-12K Medium respectively, with 10% fetal bovine serum.

**Seahorse experiments:** We used the Seahorse XF Analyzer to determine the oxidative consumption rate (OCR) and extracellular acidification rate (ECAR). Cells were cultured in Seahorse XF 24 cell culture microplates for 48 hours and incubated in 5% CO$_2$/air at 37°C with 500 µL of EMEM and F-12K medium for HepG2 and A549 respectively. The experiments were performed when cells were ~80% confluent. The running media was a modified DMEM buffer containing (in mM): CaCl$_2$ .8, MgCl$_2$ .6, K$_2$HPO$_4$ .5, KCl 5.33, Na$_2$HPO$_4$ .5, NaCl 130 mM glutamine 4, and glucose 5.6.

**Drug Loading:** The drugs were added to the Seahorse XF 24 drug injection plates. We ran two different experiments. Experiment one consisted of the addition of vehicle, myxo, with a final concentration of 1050 µL, with subsequent additions of oligo, BKA, and CATR after, wash of which had a final concentration of 1100 µL. The second experiment consisted of vehicle, myxo, final concentration of 1050 µL, then 2-Deoxyglucose (2-DOG) with a final concentration of 1100 µL, 2-DOG (1100 µL), BKA (1050 µL) and oligo (1100 µL), and CATR (1050 µL), then oligo (1100 µL). The experiments ran for 80-90 minutes in both HepG2 and A549 cells.

**Laser scanning confocal microscopy.** Cells in HBSS were loaded 30 min at 37°C with 200 nM of tetramethylrhodamine methylester (TMRM). After loading and washing, subsequent incubations were performed with 50 nM TMRM to maintain equilibrium distribution of the fluorophore, as described (Maldonado et al., 2010).
TMRM-loaded cells were incubated in HBSS in humidified 5% CO₂/air at 37°C and imaged with a Zeiss LSM 510 NLO inverted laser scanning confocal microscope (Thornwood, NY) using 63X 1.4 N.A. planapochromat oil immersion lens, as described (Maldonado et al., 2010). Fluorescence of TMRM was excited at 543-nm and detected through a 560-nm long-pass filter and a one Airy unit diameter pinhole. NADH autofluorescence was imaged using a multiphoton laser excitation (720 nm, 15% power) and an infrared-blocking emission barrier filter (460 ±25 nm).

RESULTS:

Adenine nucleotide transporter and ATP synthase inhibition do not decrease respiration or increase acidification rates after blockage of oxidative phosphorylation.

Myxothiazol, Bongkrekic Acid, Oligomycin- HepG2 Cells

Addition of myxothiazol (Myxo) (10 µM), a complex III inhibitor, decreased respiration by ~95% (Fig. 3A). Sequential addition of the ANT inhibitor bongkreikic acid (BKA), (10 µM), and the ATP synthase inhibitor oligomycin (Oligo) (10 mg/mL) caused no further decrease on respiration that was already almost maximally inhibited after myxothiazol. (Figure 3A). After Myxo there was an increase in ECAR by ~70%. This was caused by the decreased respiration in the cells, that increased glycolysis to compensate for the inhibited ATP production through oxidative phosphorylation. Increased glycolysis led to increased release of lactate which accounted for the increased in the extracellular acidification rate (ECAR). After BKA and oligo there was no subsequent change in ECAR (Figure 3B). Similar results were obtained in A549 cells (results not shown).

Myxothiazol, Oligomycin, and Bongkrekic Acid-HepG2

Figure 3A: Injection of myxo occurs at ~30 mins, with the injection of BKA occurring at ~50 mins, and the injection of oligo occurring at ~75 min. As previously stated there is approximately a 95% decrease in respiration after the addition of myxo, with BKA and oligo having no effect on the respiration levels.

Figure 3B: Injection of myxo occurs at ~30 mins, with the injection of BKA occurring at ~50 mins, and the injection of oligo occurring at ~75 min. As previously stated there is approximately a 90% increase in the acidification rate after the addition of myxo, with BKA and oligo having no effect on the glycolytic levels.
Sequential addition of CATR (20 μM), and oligo (10 mg/mL) after Myxo had no effect on the cells since respiration had already decreased nearly 100% after Myxo addition. (Figure 4A). Myxo increased ECAR levels were no further increased by CATR and Oligo. (Figure 3B). Similar results were obtained with A549 cells (data not shown).

Inhibition of ANT alone in the presence of fully functional oxidative phosphorylation does not decrease respiration.

In this experiment BKA was added first to determine the effect on respiration when Myxo was not present. BKA, an inhibitor of the adenine nucleotide transporter, would be expected to block ANT and subsequent ATP translocation causing a decrease in respiration. Contrary to expectations injection of BKA (10 μM) had no effect on the mitochondrial respiration. Sequential addition of oligo (10 mg/mL), which inhibits complex V in the respiratory chain, blocked ATP hydrolysis, decreasing mitochondrial respiration by ~40% (Figure 5A). BKA had no effect on the glycolytic levels in HepG2 cells as determined by ECAR. However, After the injection of Oligo, there was an increase of ~40% (Figure 5B). The same experiment was performed using A549 cells with similar (data not shown).
When CATR was added first, followed by oligo, as it was the case with BKA, there was no decrease in respiration or increase in acidification rates. The lack of response to BKA and CATR occurred both in HepG2 and A549 cells.
Confocal Imaging:

Cancer cells maintain ΔΨ both through oxidative phosphorylation and ATP hydrolysis:

After Myxo cells can maintain ΔΨ because the ATP synthase work in reverse when oxidative phosphorylation is inhibited. Subsequent addition of oligomycin that inhibits the ATP synthase collapsed the ΔΨ. The collapse of the ΔΨ is indicated by the decrease in TMRM fluorescence (Fig. 7).

![TMRM fluorescence](image1)

**Fig 7:** The TMRM fluorescence shown after the addition of myxo proves that the mitomatrix is still able to maintain a membrane potential even after the inhibition of respiration. When oligo is added we see the TMRM is released from the mitomatrix demonstrating a collapse in the ΔΨ. This indicates that when respiration is depleted, cells are able to generate ATP from an alternate source via reverse hydrolysis through complex V in HepG2 cells.

Cancer cells utilize glycolytic ATP to maintain ΔΨ

In order to determine if the ATP being utilized by the mitochondria in the absence of oxygen was from glycolysis, we inhibited the cells use of glycolytic ATP with 2-deoxyglucose (2-Dog). Addition of 2-Dog after respiratory inhibition with 2-Dog collapsed the ΔΨ. This confirmed that mitochondria utilize glycolytic ATP in order to make up for the loss of ATP generation from respiration (Fig. 8).

![Glycolysis inhibition](image2)

**Fig 8:** In order to determine if the ATP being utilized by the cells was glycolytic ATP, glycolysis had to be inhibited. When 2-Dog inhibits glycolysis we see a large drop in TMRM fluorescence. This loss of TMRM indicates a collapse in the ΔΨ which proves that the cell is utilizing glycolytic ATP in order to make up for the blockage of respiration in A549 cells.

BKA and CATR failed to block ATP translocation in cancer cells:

BKA and CATR were added after respiratory inhibition with Myxo with the expectation that the inhibition of ATP
translocation will collapse $\Delta \Psi$ as is the case for inhibition of ATP synthesis after Myxo. Myxothiazol caused a slight depolarization of mitochondria. Subsequent addition of either BKA or CATR did not decrease $\Delta \Psi$ indicating that ATP hydrolysis was still maintaining $\Delta \Psi$. To prove it we inhibited ATP synthesis/hydrolysis with Oligo and it collapsed $\Delta \Psi$ indicating that ANT inhibition does not prevent ATP translocation. (Fig. 10).

**DISCUSSION:**

Cancer cell bioenergetics is characterized by a high rate of glycolysis and the suppression of mitochondrial metabolism. This is commonly referred to as the Warburg phenomenon (Rey et al., 2010). To study the role of f ANT in cancer cells expressing the Warburg phenomenon we used the specific inhibitors bongkrekic acid and carboxyatractyloside along with inhibitors of complex III (Myxothiazol) and complex V (Oligomycin) of the respiratory chain.

The effects of the inhibitors on mitochondrial metabolism were determined by measuring respiration and mitochondrial membrane potential. The effects on glycolysis were assessed by measuring the ECAR.

Myxothiazol also decreased respiration by ~90%. In the presence of Myxo cells were able to maintain $\Delta \Psi$ because cells can hydrolyze ATP through the ATP synthase working in reverse. Respiratory inhibition also increase ECAR because cancer cells

---

**Fig 9:** When BKA was added after inhibiting respiration we expected to see a collapse of the $\Delta \Psi$ from the loss of ATP generation in the mitochondria. As indicated by the confocal imaging, the $\Delta \Psi$ is maintained even after the inhibition of ANT. Only when we add oligo and shut down ATP hydrolysis do we see a collapse in the $\Delta \Psi$ in HepG2 cells.

**Fig 10:** When CATR was added after inhibiting respiration we expected to see a collapse of the $\Delta \Psi$ from the loss of ATP generation in the mitochondria. As indicated by the confocal imaging, the $\Delta \Psi$ is maintained even after the inhibition of ANT. Only when we add oligo and shut down ATP hydrolysis do we see a collapse in the $\Delta \Psi$ in HepG2 cells.
can compensate the decrease in ATP production through oxidative phosphorylation with an increase in aerobic glycolysis (Wang et al., 2010).

BKA and CATR are both inhibitors of ANT and each bind with high affinity to two specific conformations of carriers that are known as BKA and CATR carrier complexes (Klingenberg et al., 2008). The addition of BKA and CATR after myxo caused no further decrease in respiration/increase in acidification rate because. Myxo has already forced a maximum decrease in respiration and subsequent increase in ECAR Oligo also had no effect on respiration or the acidification rate for the same reason as BKA/CATR (Figures 3A-4B).

In order to determine the effect of inhibition of ANT on respiration and acidification rates we added BKA, CATR, and oligo when respiration was not inhibited. I expected that both BKA and CATR would decrease respiration by inhibiting ANT. However, respiration was maintained after ANT inhibition. To prove that ATP was still being translocated in the presence of ANT inhibition Oligo was added (Figure 5A). When oligo was added and ATP synthase was inhibited, respiration decreased by ~60% in HepG2 cells. BKA and CATR did not increase the acidification rate and subsequent addition of Oligo increased ECAR by ~40%.

To determine how inhibition of ANT played a role in ΔΨ we added BKA and CATR. We expected that ANT inhibition would block ATP translocation and collapse ΔΨ after respiratory inhibition. However, neither BKA or CATR depolarize mitochondria after Myxo indicating that ATP was still available for being hydrolyzed to maintain ΔΨ.

CONCLUSION:

These results supports the conclusion that in cancer cells the adenine nucleotide transporter is not the principal transporter for ATP translocation.
Chapter One

Rochester, MN
May 13, 2013
9:00PM

Max gently worked the hypodermic from Annie’s arm. His hands were trembling. Her skin didn’t want to let go of the needle and he had to tug a little. The bruised skin rose with the needle before popping free with a tick. He let the needle drop. It crashed against the tiled floor and rolled behind the toilet. The sound echoed through his head. He brushed the wet hair back from her face. Black hair dye ran from her scalp, through her eyes, and down her cheeks. He dipped a cloth in the bath water and wiped the black away from her face. She’d been there in the tub for a while. The water had gone cold. Her skin was china white. Her lips were blue. She looked sad. A great sob welled up inside of Max and tried to escape, but he forced it back down into his chest. He clamped his hand over his mouth, squeezed his eyes shut, and held his breath. When he exhaled he grabbed her hand and held it to his face:

_Aw Annie._

Max reached under her arm pits and lifted her out of the tub. She was starting to take on water. She was heavier than he remembered. Like when he used to pick her up and twirl her around the living room, when they used to dance all night. She was lighter then and Max was stronger then. As he pulled her from the tub he slipped on the polished floor and fell onto his back—his head bounced off the ceramic tile. Annie landed on top of him with her head on his chest and he laughed. With his arms wrapped tight around her he laughed hard and loud, almost choking, but as abruptly as the laughter hit him it cut away, replaced by a ringing in his ears, and a quake in his chest. So Max stayed there on the floor, holding Annie to him—willing her back. A small spider crawled across the smoke stained ceiling. It stopped right above him and lowered itself on an invisible strand of web. It hovered just above his face. Max stared straight up and the spider hung motionless.

_What should we do tonight?_

Max hated asking, but he had to. Even though the odds were against the two of them ever wanting the same thing at the same time he had to ask. He had to do that for her. She would do the same for him:

_Let’s invite some people over and have a party._
_That’s a great idea._
_I thought you’d like that._

Annie leaned in and pressed herself to him. He grabbed her face and kissed her on the lips:

_You’re so cool._
Max blew at the spider and it climbed back up to the ceiling in retreat, pulling in the webbing like it was armed with a grappling-hook pistol. Max worked his way out from under Annie, cradling her in is his arms, and gently lay her on the black and white checkered floor. From a stainless steel rack that extended out from the tiled wall above the cast iron claw foot bathtub he grabbed the Justin Bieber beach towel:

_Wow...Justin Bieber, that’s...wow._
_I got that because I knew he was your favorite. Do you love it?_  
_Yeah._

Annie giggled:

_Liar._
_No, it’s—it’s great...seriously, this is my present?_  
_Not all of it. Stay here, I’ll be right back._

Annie ran off into the bedroom. Max held out the towel. A towel sized Bieber in a leather jacket smoldering and looking as badass as he could for the ladies:

_You’re killing me in here._  
_Just a second._  
_I’m waiting. I mean, it’s my birthday, but whatever._

Max tossed the towel on the living room futon and lit a candle. From under the futon he pulled a black box. He sat down and Annie came back in from the bedroom. He looked up and suddenly every word escaped him—every thought. For a moment Max forgot where he was and who he was. Annie stood before him in a pink latex nurse’s uniform. Pink thigh high fishnets ran up her legs. She stood on pink 5 ¼ inch pumps. In one hand she held a syringe while waving a small plastic baggie of crystals in the other. Annie went to him, climbed on him, and straddled him. She hovered over him; her boobs pushed up and exposed:

_Happy Birthday Max._  
_You’re so cool._

Max did his best to dry her off and then wrapped her carefully in Bieber. He tried to pick her up, but she was starting to get rigid. He had to force her legs at the knees. Her joints popped and he managed to get her into a cradle position so that he could scoop her into his arms, and carry her into the bedroom. When he set her on the bed he had to force her legs straight and the cracking, the sound of snapping twigs, nauseated him. Holding back the bile rising up in his esophagus, choking back the burn, he used his weight to straighten on the bed, as if he were struggling with a fitted sheet. But when her spine popped, she flattened out. Max climbed off of her and went to the bedroom dresser. He pulled the top drawer of the dresser open and dug through a pile of Annie’s panties until he found what he considered to be an appropriate pair, not too fancy, sexy, but not slutty, and very lady like. Then he went into the
closet and found a dress. Annie loved wearing dresses, especially in the summer. The closet was filled with dresses. She’d done the seasonal wardrobe switch over a couple of weeks ago—exchanging jeans and long sleeve t-shirts for light sleeveless dresses of all sorts. He flipped through the vast selection and decided on red number with white polka dots, the same dress she was wearing when they’d met in the university library. She’d been there researching Karl Marx. He was browsing through the small popular fiction section near the entrance trying to decide whether to pick up something by Stephen King or go with a three year old collection of short stories. Annie appeared from nowhere:

That’s a great collection.

Max had been drinking, his head was swimming, and his face felt hot. When he looked up and saw Annie he was immediately struck by her presence, her visual appeal:

That is a really cool dress.

They left the library together and went to Max’s apartment. They got high. They drank wine and bourbon. They talked all night about philosophy and writing and movies and music. He read her some of his poems. She sang for him in Russian. Since that night they’d rarely been apart and even when they were it was for little longer than an evening. Then one day Max got a call. He walked into the bathroom. Annie was sitting on the toilet lid, painting her toe nails blue. Max watched her for a minute. She had this glow, this ethereal mist that hung around her, like a messenger from beyond:

I have to leave for a couple days.
Why?
I have to help an old friend.
How long will you be gone?
Just a couple days, I promise.
Will you call?
Twice a day.
You better.
I will.
Okay.

Max put Annie’s feet through the panties. She was getting stiffer by the minute and her legs were not cooperating:

C’mon sweetie, you gotta help me out here.

Climbing on top of her made it easier to bend her legs enough to slide the underwear into place, but he had to reach under her ass to secure them properly. The dress was less of a problem. It slid up easily. He just had to snap her arms to get it up over her shoulders, but he managed it without screaming.
Max was worried. He’d called Annie to tell her he was on his way home, but she didn’t answer. He left a message and expected his phone to ring at any time. It never did. He stared that fucker down all the way home from Stillwater. Every five or six miles he’d check his cell to make sure it was working. He’d call again, but Annie wasn’t answering. Then he’d throw the Samsung back into the passenger seat and pile fear on top of concern on top of worry. It was the longest trek he’d ever made from Stillwater to Rochester. He smoked cigarette after cigarette. He turned the radio all the way up and listened to the loudest, heaviest music he could find on the dial. Max kept telling himself that she was fine, that nothing was wrong—that she was taking a nap or at a movie or her phone was dead—she was always letting the battery die on that thing. She’s fine. Everything’s fine. *Bullshit.*

Annie was a big girl; she was a grown up, but she was fragile on the inside. She hurt easily and Max had been gone almost three weeks when he had promised her two days. He called every day. Sometimes three times a day:

*When are you coming home?*
*Soon, baby, I swear.*
*I hate being here without you.*
*I’m sorry luv.*
*I miss you so much.*
*I miss you too sweetheart. I love you.*
*I love you back.*

And now he couldn’t make the Riviera go fast enough.

When he had her fully dressed Max sat on the bed with her for a long time with his head in her lap. His mind screamed, “Bring her back!”

The sun was coming up.

Max grabbed Annie’s hand. It was so cold rigid. He leaned over her and pressed his lips against her forehead. His tears fell into her hair:

*You’re so cool.*

On the way out of the house he dialed 911 on Annie’s phone. When the guy on the other end asked him who he was he told him the address and that Annie was dead. The guy asked for his name. Max hung up the phone and left it on the front steps.

Annie knelt in front of Max at the futon with a goofy earnest smile:

*What’s going on there?*
*What do you mean?*
*You got this look on your face.*
What look?
That look—you goofball.

He grabbed her and kissed her face:

Stop it. I wanna ask you something.
Okay. Ask.

Annie presented him with a box:

Open it.

It was a ring. A gold ring:

Will you marry me?

Max was speechless. He almost cried:

Hells yes, I’ll marry you!
Really?!

Annie tackled him, and kissed him a thousand times.

Max twisted the gold ring to make sure it was secure on his finger. He lit a cigarette and drove off in the Riviera.
Chapter Two

Two Harbors, MN
Same day

The green digital display on the radio said it was 10:30PM. Two and a half hours late on a school night. Molly checked her make-up in the passenger’s visor mirror. Her dad was going to be pissed. They had a deal. He’d stay out of her life for the most part and she’d be home by 8:00 on weeknights. It was a simple agreement, but one that Molly had serious trouble adhering to, and was in danger of losing if she wasn’t careful. She looked at her face in the mirror. Everything seemed okay. She fixed up the black lip stick smudges and straightened her hair, pulling it back, and wrapping it into a blonde ponytail. Molly looked over at Leo who was keeping his eye on the road. She admired his unshaven face. He had the look of a man who thought little of his appearance. He spent a lot of time and a lot of money achieving this look. From his beat up skater shoes all the way up to his purposefully disheveled hair. It was an amusing practice that Molly found cute and endearing:

You should come in and say hello to my dad.

Leo laughed in response. Molly wasn’t surprised. In the three months they’d been dating he’d met her father only once:

It might help smooth things over.
I think I’ll take a rain check on that, sweet heart.
Fine.

She didn’t blame him. In the last three weeks she’d been late five times. It wasn’t Leo’s fault. He always reminded her of the curfew, but she always waved it off, wanting every second of his time that she could get a hold of. She adored him like a school girl does, and he was good to her. He was never mean to her. He was never condescending. Leo went out of his way to make her feel his equal and she doted on him for it. Was it love? She was sixteen, she didn’t care. Molly was having the time of her life, and she didn’t want to lose that. Leo would say:

Then stop being late.

Yes, that’s what it came down to, and her dad was going to be super pissed. She’d try to reason with him. They were studying—and they were. Of all the things a father needs to worry about when it comes to his daughter, Molly had already done. She got drunk at parties, she smoked when she got drunk, she was failing Russian, and she and Leo had a sexual relationship, but none of that occurred tonight, or any other weeknight for the most part. Tonight, they were studying. Leo was helping Molly with her Russian studies. An amusing concept, Leo was smart, but not that smart. He could walk you through a calculus formula without blinking, but Russian is a level four language, and Molly gave him very little warning. She didn’t really care. Russian was her excuse to see him. When he found a website that would teach him Russian while he
helped her, she got a little irritated, but that quickly shifted to fascination at how hard he worked to be of help to her. If only her father could witness those moments, the moments when Leo proved himself a man of honor, selfless, and dignified. But that wasn’t going to happen tonight, she was on her own.

Leo eased the pickup—a 1988 Dodge—onto the property, eased it up around the circle drive, and put it in park just feet from the front steps of the house. Molly opened the passenger door, but turned back:

*If you came in with me, we could tell him we ran out of gas.*
*You could tell him that anyway.*
*Come on!*

She leaned in, knocked his hat off, and kissed his face. He laughed:

*I’m not going in there.*

She stopped and sat back in the seat:

*Ugh, here’s your stupid hat.*
*Hey, the hat goes with the truck.*

He was right about that. The hat went with the truck, but the truck was just as stupid as the hat. She leaned in for one more kiss and put the hat on his head:

*Dork.*

She climbed out of the truck:

*See you tomorrow.*
*I’ll be here at eight.*

Molly shut the truck door and tucked her white button down shirt into her red plaid skirt. She straightened her tie, waved back at Leo, and walked into the house.

Richard had been waiting all night for Molly to get home. She was supposed to be home by eight on a school night. It was now ten thirty. He was getting used to her not listening to him, not paying attention to his concerns, ignoring his rules. They argued about it almost daily. It was exhausting. He grew weary of her nightly return when he’d question her whereabouts and her ability to read a watch, and she would tell him to quit being such a drama queen. It’s all about the arguing with her. Molly refused to see that all he wanted was a little order, a little respect. She was a big girl, he knew that. He wasn’t so much concerned for her safety. She knew the ropes. She could take care of herself. Not to mention she was always with Leo. He
was a good kid. He was strong and smart. That wasn’t the issue. He trusted her. The issue was she refused to let him be in charge, to let him be the parent.

The front door swung open and clicked shut. She was home.

He’d been waiting since seven, sitting in his office chair, almost motionless. Richard didn’t expect her to be on time, but he sat still and waited. He’d had to pee for the last hour, but he sat there. He’d thought about calling her, warning her, but she never answered her phone when he called, and she never listened to his messages. He thought maybe he could text her if only he could think of some code she could follow, some secret way of telling her not to come home, to stay away, to get far away.

He could hear her in the foyer area. She was looking for him:

Daddy?

Molly shut the front door behind her, expecting to see her dad standing at the stairs, waiting for her, but he wasn’t. The radio in the living room was on, which was typical. Her dad liked to listen to MPR every night. He enjoyed BBC radio. She hated this part. The not knowing where he is. She’d have to find him. She’d rather just go straight to her bedroom and call it a day, but if she didn’t find him, he’d find her. She wondered if he’d be drinking. That was never a good thing. He stopped. He’d been clean for almost a year, but the memories of what it was like have never left her. She felt ashamed that she would automatically jump to the worst possible conclusion, but Molly was just as scared of her father as she was proud of him:

Daddy?

She heard coughing from inside his office. The lights were out in the hall leading to his office and she tried to switch on a lamp, but the knob spun free. It was disconnected from the switch, so she screwed it back on, and the lamp lit up. A murky pool of light spread over the table where the lamp was sitting, but that was about it. It didn’t spread any farther. Better than nothing. She heard another cough from the other side of the office door:

Dad?

Her dad had worked hard to turn his life around, she had no right to assume anything, but when she pushed open his office door and looked in, Molly wished her unjust assumptions were right, that he’d been drinking.

Richard watched as his daughter pushed the door open. He wanted to pee himself. He wanted to scream for her to run, but it was too late—she was here. They’d catch her. They’d kill her. They’d kill them both.
When Molly came into the room and saw everything, the look on her face, the horror of recognition, it broke Richard’s heart. He wished he could help her. But they were already behind her. He watched them grab her, and hit her, and drag her away:

*Molly*

He was quickly subdued with the butt of a gun.

Molly felt the blood run from her face and life fall from her fingers. Her chest tightened with fear and she was frozen. Her dad sat at his desk, tied to the chair, and there were two guns in his face. Then she was surrounded. She tried to get away, but they grabbed her, and they punched her in the head. Her dad yelled:

*Molly*

And they knocked him out. They hit him in the face with a gun. Molly screamed:

*Daddy*

And she was hit in the head again. Everything went black.
Chapter Three

Meanwhile
Stillwater, MN
The day before—

The interior of Room #201 was as you’d expect any historic bed and breakfast to be except for a couple of things, like a company laptop, for instance, open and set on a table near the window overlooking Water St. in downtown Stillwater. The battery had given out. Justin dug through a back-pack and located the charger. While he waited for the laptop to reboot he noticed something else out of place—a half empty bottle of bourbon and a glass with melted ice. He picked up the glass and sniffed the contents. From the smell, the drink had apparently been abandoned, not finished. Glancing out the window, he observed the action at the Bistro across the street. The watch wrapped around Justin’s wrist said that it was almost noon. The lunch-hour was just getting started. Professional types in smart suits parked their Lexuses and their Acuras on the street, and plugged quarters in the two hour limit meters posted along the curb. They converged on the little restaurant to do business, talk shop, and make deals. The sidewalk tables were filled with lawyers, contractors, corporate movers, and local politicians gathered to plan the future, but mostly just to make an appearance. Justin picked up a plain folder from the bed. It was labeled #C665007, the client number. Inside the folder there would be a semi-complete file, enough information for the agent to locate the client complete the objective. Justin flipped through background information, phone bills, bank statements, and pictures. He stopped and studied a picture of the client sitting at a sidewalk café, the restaurant across the street when the laptop dinged. Justin logged in and an instant message popped up:

What are we looking at?

Justin replied:

Everything is here.
The agent?
Missing.
The client?

Justin looked at the picture and out the window at the restaurant across the street. Three of the seven tables were occupied. A bus boy prepped a table for an incoming party of four—the client’s party:

Confirmed.
Continue.

The final word. Justin had anticipated as much:

And the agent?
Later.

He closed the laptop. That was all the info he needed. First things first. Clear the room. He stuffed the computer, the bourbon, and the file into the back-pack. He dumped the glass and wiped it clean of any finger-prints. He looked at himself in the mirror and considered shaving his black Mohawk. That would have to wait. He brushed off his pinstriped shirt, combed his goateee, and put a pair of mirrored sunglass over black eyes. With the back-pack slung over his shoulder, Justin left room #201 and took the stairs into the main lobby of the Water Street Inn. The wino behind the front desk was out cold—knocked senseless by the sedatives Justin had slipped into the bottle he offered the clerk in exchange for access to the room. He stopped and checked the clerk’s pulse. He’d be fine. Just packed up the bottle of tainted wine and went outside onto Water Street.

Jamie hated the lunch rush, bunch of corporate climbing drinking and showing off to each other, challenging each other to little power struggles, and tipping very little. He preferred the dinner crowd when the same company men treating their wives and mistresses to a night out. Spending more than necessary and tipping large to impress the ladies. Lunch consisted of business expenses and an automatic sixteen percent gratuity added to each bill. He was filling in for Janine. She had called him the night before and asked him to switch shifts with her. She was out of town, visiting family. He wanted to tell her no. He was three deep in a twelve pack of Budweiser when she called, and he had no plan of stopping until bed time, but he liked Janine, and he owed her a favor. She covered for him when he called in sick a week ago, so he told her he’d be glad to take over the lunch shift, and continued drinking until the twelve pack was empty. At least it was a quick shift. He had to punch in by eleven and the rush would be over by one thirty at the latest. In that window of time the restaurant would seat sixty to seventy people and Jamie would barely have time to breathe, and before he knew it the shift would end. Relatively easy money even if it wasn’t a lot. Janine was in charge of the sidewalk tables. Considered a perk for those with a little seniority. Jamie didn’t mind the sidewalk. It got him out in the air, but going back and forth from inside the restaurant, wasn’t helping his hangover much, and he found himself drinking water whenever he had a second. He was busy filling a drink order for table seven, a party of three guys in high profile suits, when Machine walked onto the sidewalk. He looked out of place in his black & white pinstriped shirt. The shirt was un-tucked and hung neatly over his black jeans. His stark black Mohawk didn’t exactly help him blend, but the part that seemed odd and unsettling was the way he walked right up to table seven and handed an envelope over to the man in gray. The man in black and the man in blue were visibly unimpressed by the interruption, but when the man in gray stood to face off with Machine, they took notice, and backed away from the table. The stand-off was brief and the man in gray dropped to the sidewalk. Jamie set the drink tray down on the bar:

Call 911!

Justin crossed through the traffic on Water Street without looking, trusting that the downtown drivers would give way, and let him through, which they did, used to the
entitlement thoughtless pedestrians think they have, cutting into traffic wherever they see fit. Only one driver honked at him, and yelled from the driver’s side window:

You gotta be kidding me here!

There was the client wearing the same gray suit and sitting at the same table as in the picture. Justin walked right up to the table without so much as pausing. He stood before the client offering an envelope. The other two suits, black and blue, barely acknowledged his presence, while the client just sat there and smiled. Justin stood still and waited until the client took the envelope. Inside the envelope were more pictures—photos of a young lady. The client shuffled through the photos and his smile faded:

What’s this?

Justin didn’t say anything. He didn’t have to. He could see from the client’s expression that he knew exactly what the pictures were:

So, who the hell are you? Lawyer?

Justin said nothing. The client grew impatient:

What is this, some kind of threat?

Justin said nothing and the client stood up. Black and blue backed off from the table. Blue offered a suggestion:

Maybe we should reschedule.

The client stared at his reflection in Justin’s sunglasses:

Listen, you can tell whoever sent you that I’m taking care of it.

Justin said nothing. He just reached out, grabbed the client by the head, and twisted. The client’s neck snapped and Justin let him drop to the sidewalk in a heap. Black and blue were stunned. A lady from table three screamed. A man from table one ran to the client’s aid, barking orders:

Make room! Give him some air.

Justin exited the scene as quickly and deliberately as he entered.

The emergency response team arrived twenty minutes later. First the paramedics in the fire trucks, then the police, and at last the ambulance. It didn’t matter all that much. The guy was dead. With his neck broken, he was dead before he hit the pavement. The cops were busy
questioning patrons. Black and blue seemed to have plenty to say, talking with their hands as they describe what they saw. The client was hauled away on a stretcher. Machine was long gone, a stranger with a Mohawk. All the employees were being held for questioning, one at a time, and even though he’d probably seen more than anyone else, Jamie was fifth in line. He hated the lunch hour in general, but now with this added bit of excitement there was no way he was getting out before two o’clock. He smoked a cigarette and waited for his turn to talk.
Chapter Four

Rochester, MN
Before—

In the St. Mary’s emergency room, the waiting area is divided into two sections. To the left is an open area with rows and rows of sad looking people listening to the news on the one available television. To the right is a smaller area, less seating, children’s toys scattered over the carpeting. This branched off from a narrow area with vending machines, a third TV, and three chairs around a low table. Max paced this area like a nervous bear, bouncing from wall to wall. Every five or six minutes he’d stop and glare at the nurse behind the front desk, to see if she was even paying attention to him, or if maybe it had occurred to her that he’d been waiting for more than an hour, and that she hadn’t so much as looked up from the desk since he checked Annie in. He was starting to resent this lady for her authority. He was worried about Annie. He wanted to know that she was okay... or not okay—whatever—he just wanted to know, and this fucking nurse was standing in the way. He wanted to yell. He wanted to throw a fit, anything to get this lady’s attention. She looked over at him:

You can see her now.
Thank you.

It was bad. She looked like she’d been run over by a truck. She was covered in cuts and bruises, wrapped in gauze, tubes coming out of her arm and her nose. Her head was wrapped in a bandage; blood soaked through just above her eye and her right ear. Her left ear was completely bandaged over, pressed flat against the side of her head, pressed against her hair. Her left arm was broken and hung in a sling. She’d been put in a brace to protect her broken ribs. Her nose was broken. The sight of her was terrifying. Max couldn’t tell if she was alive. And when she breathed he was worried the effort would kill her. When he reached out to touch her hand, she opened her eyes. The fear on her face broke Max’s heart. She pulled away. He let her:

Oh sweetness, I don’t know what happened to you.

She stared at him. She looked terrified. She struggled to speak, but started crying instead. Max tried to ease her:

Sweetie, it’s okay. You’re safe.

He couldn’t wrap his brain around the fear she was wearing. It was clear that he was the cause, but he had no idea why:

I’m going to leave you alone so you can rest.

As he stood to leave she grabbed his hand and squeezed it. He leaned in and kissed her face:
I love you, Annie. I really do.

She squeezed his hand tighter and he understood that she needed him. He sat back down:

I’ll stay.

She let her eyes close.

Max opened his eyes with a strong urge to urinate. He sat behind the wheel of the Riviera waiting for his mind to catch up and remind him of where the hell he was. According to the radio it was midnight. He pushed open the driver side door and climbed out into the darkness. His head felt like a pummeled watermelon, his hands were shaking from withdrawals, and his bladder ached—one of the many downfalls of sleep. He was parked at a rest area somewhere between Silver Bay and Two Harbors in northern Minnesota—and really had no idea why. Was he going to Canada? He popped the trunk open, pulled out a bottle of bourbon, and a small black bag. The effort to close the trunk about knocked him over. He stood and waited for his head to stop swimming long enough that he could get to the restrooms before he pissed himself. He followed a wavy path to the beige brick “Welcome Center”, led by blurry lights, the faint sound of traffic from the highway, and something else, something unfamiliar that he hadn’t heard in years, a natural white-noise, the sound of water—big water—the sound of waves hitting the shore. Heading straight to the bathroom, but leaning heavily to the left, he crashed into the wall several feet from the entrance. The bricks felt cool against his skin, so he leaned and pressed face against the rough surface, inviting the sensation to spread through his head, and straighten him up a little. That didn’t happen. The coolness from the bricks quickly retreated, overrun by his internal temperature. He chased it, rolling his face from ear to ear and back, but the cool was brief and fleeting, chased away by heat radiating from under his skin, so he gave up and stumbled to the heavy glass door that led in to the building. Inside, the foyer was lit by cold florescent bulbs, diffused through scratched Plexiglas coverings. The floor and the walls were gray tiled. A Pepsi machine stood to the left of the entrance to a You Are Here map. There was a large section of blue on the map: Lake Superior. According to the red arrow Max was on a highway just north of Duluth and he had no recollection of getting there. What he did remember was that Annie was dead.

He remembered leaving the house and heading north with no particular destination in mind. He left Rochester via Highway 52, and headed toward the Twin Cities. He could remember pulling into Canon Falls for another bottle and stopping in at Players, a strip club, for a couple drinks. A couple turned to a few. A few turned to many. He made several trips to the bathroom for meth shots. Instead of going downstairs where the girls danced and took their clothes off he stayed in the bar where he could drink. A monitor hung over the bar that showed the main room, but it was like trying to watch soft porn on a scrambled channel. The dancers would stop in the bar area presumably to provoke interest. They were beautiful, they were exotic, and every one of them reminded Max of Annie. After about an hour he had to leave before he screamed and his heart exploded all over the floor. He stopped again just south of St. Paul at the “House of Coates”, a shabby little farmer’s bar and grill—the main attraction in the
town of Coates—Population 161. The inside was populated by guys in John Deere hats and flannel shirts having drinks with their wives and girlfriends. Max was reminded of that scene in movies when the stranger from out of town enters the establishment and everything stops, and everyone looks. Only in this case no one looked, no one cared except the bartender who didn’t seem to care all that much:

**You need something?**

Max panned the room, observing the drink of choice:

**Budweiser?**

After a six pack, he used the bathroom, headed back out on the highway, and continued north. From Highway 52 he jumped over to I94 and continued around the cities. Max kept the radio tuned to 93X with the volume up as loud as he could take. As he transferred over to Interstate 35 north, he was mesmerized by the Minneapolis skyline. Great structures reaching toward the clouds, brilliantly lit, an oasis of concrete and glass—the last thing he remembered.

In the Men’s room Max was faced with five porcelain urinals that were attached to the white tiled wall. Shining stainless steel piping ran from the porcelain and attached to the tiling. He walked along a row of seven grey metal stalls and stopped at the end and stepped into the stall built for wheelchair access—plenty of room for his particular needs. Max liked the space. He hated the claustrophobic feeling he got from inside the standard stalls. He shut the metal door behind him and slid the stainless bolt over though the slot. A plastic baby changing station hung from the tiled wall to his right. He set the bourbon bottle and a mini-zip-lock filled with white powdered crystal onto the flat surface of the toilet paper dispenser. He unzipped his jeans and tipped over right against the baby changing station. His legs buckled under him and he almost went down, but he held on to the changing station like he was hanging from a window sill trying to keep from plummeting to the street. He grabbed one of the steel courtesy rails and fumbled himself onto the American Standard toilet, using all of his upper body strength, dragging his legs behind as though they were useless. Max wondered if the handicapped had as much trouble. Deciding well against trying to stand again Max pulled his pants down around his ankles and relieved himself from a sitting position. As his bladder drained so did the blood from his face and he struggled to keeping from passing out—not wanting to die like Elvis.

His nostrils felt dry and packed, he couldn’t get any air to flow through, so he stuck his pinky finger in the right nostril and scraped. Dried up snot and crystal meth clung to the end of the finger, jammed into the untrimmed nail. He ate it and explored the other nostril, revealing much of the same. After a minute the residual crystal began to take effect and he could breathe again. The cloud in his head began to clear. Max grabbed and opened the tiny zip-lock and pinched a chunk of powder between his thumb and forefinger and sniffed it up on nostril. He grabbed another little chunk and sniffed it up the other. He squeezed his nostrils closed and snorted hard. When he released the grip air and powder shot up into his brain. He felt his pupils
dilate like the f-stop of an old camera. His ears popped and he could hear clearly. The drone of traffic from the highway became much more prevalent and the crashing of the waves more defined. He could hear the faint buzzing from the fluorescent lights above, water dripping from a leaky sink, and a car door slamming shut:

Shit.

The last thing Max wanted was to see another person, or be seen. He grabbed the bourbon and took a big drink. The burn made him gag and he dry heaved a couple times. He stood and pulled up his pants, all balance and clarity had returned. He took another drink from this bottle. This time the burn was minimal. He flushed the toilet, left the stall, and went to the sinks. He stopped in front of the leaky faucet and washed his hands. Then he splashed cupped handfuls of cold water over his face, and shut the faucet off tightly which stopped the leak and dried his head off with coarse, nonabsorbent paper towels from an automated dispenser. He had to wave his hand under the sensor three times to get enough paper for his purposes. In the mirror he looked as though he’d aged a thousand years. His eyes were dark and sunken. The scar across his left eye looked very pronounced against the pale of his face. He had no idea how he’d got here, but at least he was alive:

Lucky me.

He thought he heard a scream or a squeal from outside the building and then the heavy entrance door open and close:

Time to go.
Chapter Five

Somewhere along Highway 61
Just south of Two Harbors—Same Night

When the truck came to stop, Molly dreaded what was in store. She had no way of knowing where she was or how long she’d been in the cage. When she came to she was in absolute darkness and being bounced around. From the sound of the engine and the passing of cars she was able to decipher that she was in the back of a truck or a van that was heading down a highway. The look on her dad’s face when she had walked into his office, the fear and shame his eyes expressed, terrified her. He was a strong man, a hard man. He knew nothing of fear. He had eaten entire board rooms alive. But when Molly walked into his office and saw him with that gun to his head she saw in him something she’d never have dreamed of. She saw hopelessness—a man who’d run out of answers, and then she was knocked out. One thing Molly was sure of was that whatever this was about it was an attack on her dad that had little to do with her. There were at least five men in that office. This was planned. Such knowledge offered her little comfort, but there was hope she’d be kept alive for a while. As the vehicle barreled down the highway she was thrown from side to side. When there was a bump in the road she’d be lifted in the air. Her head would hit the top of the cage and she’d slam back down. She’d located the door to the cage. It was padlocked. She’d kicked at it uselessly. Molly started banging on the side of the cage opposite the padlocked door:

Hello! I have to go to the bathroom!

There was, of course, no response, but she continued to bang on the galvanized cage wall until she felt the vehicle slow down, and finally stop. Molly heard two metal doors creak open. She was in a van. Then the blanket covering the cage was lifted revealing a man with long, scraggly gray hair. He was unshaven and wore a long trench coat. He peered in at Molly and grinned. He was missing several teeth. Molly shuffled back away from the door. The man inserted a key into the padlock and swung cage door open. He reached in, grabbed one of Molly’s legs, and pulled. Molly kicked at him, connecting with his chin. He grunted like a big dog and slapped her. Then he grabbed her by the hair and dragged her out of the van. Molly grabbed his hand to avoid having her hair ripped out of her head. The man let go and she fell to the pavement. She scrambled to her feet and made for a getaway, but the man smacked her in the head again, knocking her silly. He grabbed her by the upper part of her arm and started hauling her toward a building. Molly recognized the location. They were at a rest area. The man was dragging her to the bathrooms.

There were two access roads to two sets of parking. One road led directly from the highway to parking right in front of the lighted welcome center and continued back to the highway. A second road veered off around the backside of the building and offered parking closer to the lake. The lots were empty except for a car parked in the last space of the back lot. She screamed, hoping the owner of the car might hear. The man in the trench coat grabbed her by the throat and pulled her close to his face. He said nothing, but the look on his face told
Molly she’d better keep her mouth shut. He released his grip around her throat and grabbed her by the back of her neck and pulled her to the building. He yanked open the heavy glass door and threw her in. She smacked the tile floor. The man in the trench hulked over her. She tried to back away from him, pushing off with her tennis shoes, but he grabbed her by her arm again and hauled her up.

**Hey!**

Molly and the trench coat looked over and there stood a man in a disheveled black suit. His hair was dark. His face was pale. There was a long scar over his left eye. In one hand he gripped a bottle of bourbon. The other held a lit cigarette. It had to be the owner of the car outside. Molly stopped struggling:

**Help?**

Max thought about straightening himself up a little before leaving the bathroom, but didn’t feel like putting forth that much effort. He didn’t look that bad. He looked like a guy who’d slept in his suit. He looked tired, but not that bad. He decided to just get the hell out of there before whoever was in the entrance area could get good look, so he lit a cigarette, grabbed the bottle, and headed out. He planned to just walk right out but what he saw in the entry way stopped him in his tracks. A big ugly dude in a long trench coat was manhandling a young girl in a school uniform—she couldn’t be older than sixteen or seventeen. Her hair was messed up. She was bleeding. She was on the floor trying to scramble away, but the guy in the trench grabbed her and hauled her to her feet. Max shifted to militia mode:

**Hey!**

The guy stopped and looked. The girl looked. She was terrified. She pleaded:

**Help?**

Max took a long drag from his cigarette. The guy in the trench grunted and returned his attention to the girl who slapped at his arms. He grabbed her by the throat. Max walked directly up to him and stuck the burning end of his cigarette in the guy’s ear. The guy yelped and let the girl drop. He turned to Max with confusion and fury in his eyes. He was considerably larger than Max, but Max stood his ground:

**You should let her go.**

The girl backed out of the way against one of the tiled walls. The guy in the trench grabbed Max and threw him into the Pepsi machine. The machine rocked and Max landed on the floor. The guy in the trench went back at the girl. Max jumped to his feet:

**Okay then.**
Max charged the guy and punched him in the ribs. The guy grunted. The girls ran out of the building. The guy backhanded Max, sending him flying across the tiled floor. He advanced, hulking over Max and lifted a foot to stomp on Max’s face with a steel toed boot. Max caught the foot and twisted, throwing the guy off balance. The guy tipped to the right and Max punched him in the crotch. He howled like a wounded dog and dropped to his knees. Max got back up on his feet. The guy in the trench steadily rose and headed for the exit after the girl. Max grabbed the bottle of bourbon:

Shit.

Max smashed the bottle against the wall and ran at the guy in the trench. He jumped on the guy’s back and brought his arm around the guy’s neck and forced the jagged bottle neck into his throat. Blood gurgled from his throat. He tried to throw Max off, but Max held on. He pulled the broken glass back and drove it in again, and twisted into the juggler and the carotid. Now the blood sprayed like a sprung leak. Max drove it in again and again, hacking at the guy’s throat until finally he collapsed, and gurgled to death on the floor. Blood pooled beneath him and spread over the gray tiles. Max tossed the bottle next away and went to leave the building to see if the girl was okay. She’d probably be long gone by now, running down the highway, flagging down cars. Max could see that she was terrified, traumatized. She’d be frantically trying to get somewhere, anywhere away from here, but when Max walked out of the building there she stood. Completely still—frozen:

Hey, are you okay? Where do you live? I can take you somewhere.

But then Max saw why she wasn’t moving. The parking lot had filled up with black vans and chase-cars and beat up pick-up trucks—and more drove in from the highway. Men, soldiers, piled out of the vehicles. All of them were armed. Some with guns, some with baseball bats, some with chainsaws:

What the fuck?

Max counted forty armed men and the number was growing. The girl looked to Max. She was lost. Max put his arm around her shoulders and lightly guided her:

Come with me.

The two of them, Max and the girl, quickly shuffled to the Riviera at the end of the lot. Max kept looking over his shoulder. The enemy was advancing. Slowly and methodically they charged forward. Max opened the passenger side door:

Get in. Pop the trunk. Inside the glove-box.
The girl climbed in and opened the glove-box. She hit the yellow button and the trunk popped open. Max went to the trunk revealing an arsenal—a rifle, a shotgun, and a variety of handguns. He armed himself with two handguns, double fisted, and closed the trunk. A shot rang out and bullet zipped by Max’s ear. With the Riviera covering him, Max extended both guns straight out and fired several rounds into the oncoming horde. Three men dropped to the pavement, only to be replaced by three more. Max climbed in behind the wheel and started the car:

Get in the back seat and stay down.

The girl climbed in the back and flattened herself out on the seat. Max threw the car in reverse and hit the head lights on revealing the assailants. What had started off as forty or so attackers had grown to a hundred or more and now the bullets were starting to fly. Max slammed the Riviera into drive, stomped on the gas, and drove directly into the crowd.
Chapter Six

Meanwhile
Rochester, MN
Same Night

The rain was falling lightly on the streets of downtown Rochester and for about five or six city blocks it had the look of someplace else, of an actual city, like Minneapolis or Chicago. Up ahead on the left the Hilton Double Tree rose up eleven stories above Broadway, the new University Square with shops and restaurants reached up on the right. Justin turned onto Center Street and headed east through the Mayo Clinic compound passing by the historical Kahler Hotel, the Methodist Hospital, the Days Inn, and parking ramp after parking until emerging into a sketchy residential area less than an eighth of a mile from the busy hub of Med City. All the houses on Center Street had been converted to rundown apartments. Even in the rain low income families kept to the front yard and converged into the street. Overweight girls in belly shirts sat on front steps watching children play in the mud. Tattooed homeboys gathered around pimped out, jacked up cars that seemed to belong somewhere else. They drank cheap beer, smoked generic cigarettes, and listened to the latest in hip hop and rap. Boyfriends beat up girlfriends, wives beat up husbands. It was one of the more popular areas to shop for the illicit street drug of your choosing and as Justin drove through he had to stop three different times to avoid running down locals who used the street as if it was an extension of their lawns. They carried an air of entitlement that Justin found laughable. He wondered how hard core and confident they’d be pressed under the tires of his Impala as he took a right onto 9th Avenue and then a left on 2nd street NW.

The atmosphere on 2nd was a lot more welcoming. Screened porches and kept lawns. The boulevard was lined with tall trees that extended out over the pavement, alive and green. He pulled up in front of a newly sided, gray two story house with a three season porch. The number 927 was attached to the side of the house on the right side of the porch’s screen door and centered above a black mail box. Justin turned the ignition off and climbed out of the Impala. The rain was falling light, but steady as he headed up the front walk to 927. To his left a transplanted Elm tree towered four feet above him. To his right the lawn was healthy and green and overdue for a mowing. The house was dark on the inside. The screen door creaked like a rusted spring as he opened it and entered. He was careful to let it close slowly to keep it from slamming. His first steps on the wood floor of the porch clumped and creaked. His slip resistant, steel toed Brahmas weren’t intended for stealth and skulking. Justin did his best to walk lightly, but every soft step he took groaned loudly as he approached the front door to the house which was ajar. It had been busted open. The door jamb was frayed and splintered. It took Justin a minute to process the situation, but then he moved in. Surprisingly, the French Wood, two PanelLite Bottom Panel Finger Jointed Pine Primed Door with V-Grooved Decorative Glass swung open without a sound. Justin clicked his arm, springing a twenty one inch, telescoping steel baton, and walked as quietly as possible over the hard wood floor into the living room of 927. The main floor has three rooms: Living room, kitchen, and dining area all wrapped around a center structure of wood and sheetrock and plaster. In the living room sat a futon facing an
entertainment unit with a television, a stereo, and Sony DVD player. To the right of the unit there hung a large window looking out to the porch. Across from the window, stuffed into a corner, there was a fancy plush recliner and above in, hanging on the wall was a photograph of the person of interest, the missing agent, and a pretty girl. Their faces were pressed together. Justin went into the dining room. A polished Cappuccino Veneer Wood dining table sat in the center of the small room surrounded by four Dartford Dar Espresso side chairs. Straight ahead of him hung a window that looked out over the back yard and a faded gray deck with a gas grill and a patio table with the center umbrella folded up and three chairs stacked at the side. A small bookshelf held a variety of cook books that included Jamie Oliver’s The Naked Chef, Bobby Flay’s Mess Grill Cookbook, and Masaharu Morimoto’s New Art of Japanese Cooking. Two framed photographs acted as bookends: one of the agent with his arms around the pretty dark haired girl from the photo in the living room and one of the same girl with blonde hair wrapping her arms around the agent. Above the small bookcase hung a window that looked into the neighbor’s yard and an unkempt row of hedges. The opening in the wall on the left gave access to a small kitchen with a Frigidaire side-by-side refrigerator, a 30 inch freestanding gas range oven, over the range microwave, and a built in dishwasher—all stainless steel. The flooring was Blue Mist/Beige Classico Travertine Luxury Vinyl. A window hung over the stainless steel sink looking over a gravel driveway. The sill of the window held various potted herbs like basil, oregano, rosemary, and thyme—and another framed picture of the agent and the pretty girl. In this picture she wore a yellow floral patterned dress and had red hair. Justin walked out of the kitchen, back into the living room facing the splintered exterior door he original entered through, and headed up a creaky staircase.

The second floor of 927 has a narrow hallway with more hardwood flooring and every step Justin took creaked and groaned. The hallway led off into four separate rooms: two bedrooms, a small office, and a black and white tiled bathroom with a clawed foot bathtub, Devonshire toilet, and a wall mounted Pinoir sink with a single chrome faucet. The tub held standing water and there were no towels hanging from the stainless towel rod extending from the wall. Something glimmered from behind the toilet. Justin crouched and used the baton to fish out an empty hypodermic needle. He held it up to the light. Condensation lined the inner wall of the tiny plastic tube. Justin dropped the needle into his jacket pocket and walked out of the bathroom. The main bedroom was simple in décor. A Tuscany Villa Queen-Sized White Upholstered Bed with white pillows and a black comforter. Over the bed hung a print of Jackson Pollack’s “Lavender Mist.” A window looked out over the back yard and deck. An oak dresser held more framed pictures of the agent and the girl in various hair styles and colors. One of the drawers was left open: the lady’s underwear drawer. Justin pushed the drawer closed and went to the closet. The closet door was opened revealing several summer dresses in brilliant colors and floral patterns. The next room over from the main bedroom had been converted into an office. The hard wood had been painted white to blend in with the white walls. A framed poster print of a couple kissing under an umbrella in the rain hung on the wall over an old HP-PC that sat on a corner home office desk. Next to the tree sat a picture of the agent working under the hood of a 1973 Buick Rivera and an HP Laser Printer. Justin rolled the gray luxury office chair out of the way and juggled the mouse, bringing the monitor to life. On the screen popped up a travel itinerary—a trip for two to Moscow, Russia—booked three weeks out. Justin clicked on
the Firefox ‘History’ button and found a long list of travel sites: Expedia, Hotwire, and Travelocity. He pulled open a deep drawer from the desk that contained nothing, but a ream of 8 ½ x 11 printer paper, three empty desktop picture frames, and a stack of unused greeting cards: Thinking of Yous, Missing Yous, and Wishing You were Heres. He closed the drawer and noticed something metallic taped to the under underside of the desk—a shiny skeleton key. Justin held the key up and decided to hold onto it. He slid the office chair back into place and walked back into the hall. One more door stood between the girl’s office and the stairs leading back down. Justin turned the knob, but it was locked. He tried the skeleton key and a latch clicked. He dropped the key into his jacket pocket and pushed the door open slowly revealing three large computer monitors with flashing maps, grids, aerial photographs spread across a large computer desk in front of a window that looked out over the front porch of the house onto 2nd Street. Justin could see the Impala waiting for him at the curb. A cork board hung on the wall and pinned to it with colorful push tacks were various photographs of various well-dressed-men engaged in various activities. A small table to the left of the doorway held a large ink jet printer and to the right of the table a small black filing cabinet rested on the floor. Above the table hung a poster sized black and white photograph of the girl blowing a kiss to the camera. There was no chair. This was the agent’s office, the reason he was there. Justin proceeded to shut down the agent’s information center and pull all the pictures from the cork board when he heard footsteps from below. He remembered the splintered front door.

He stepped into the hall and listened. The footsteps clomped around the main floor—glass was being broken, drawers were being dumped. He quickly pulled the rest of the pictures and turned off the monitors. The stairs were creaking and so he quietly shut the door and waited. The foot clomping continued just outside the door and Justin could hear more drawers being emptied, and furniture being toppled over; and then nothing. He stood with his back to the window directly facing the door. The footsteps came to the door and it swung open. A bald man with a black beard, wearing a maintenance uniform walked into the small. The man held onto a large wrench. Justin wiped the baton and cracked him in the face. The man grunted as he crashed into the cork board. Another man in a maintenance uniform charged in behind him. Justin brought the baton down onto the top of his head like he was driving nails into concrete and he dropped to his knees. His oversized tork-wrench clamored on the floor as he grabbed his head and howled like a wounded blood hound. The bald man shoved himself from the wall, wildly swinging his wrench. On a back-swing Justin caught the wrench with his left hand and threw the bald man off balance. Justin swung the baton in a wide arc and hit him in the Adam’s apple, crushing the bald man’s larynx. Unable to breathe, the bald man dropped his wrench, and clawed at his throat. He crumbled to the floor wheezing and frantically struggled for air. The other man, who had long, dark hair tied off in a pony tail and face metal, was shaking off the daze from the hit he just took and getting back on his feet. He grabbed his tork-wrench and caught Justin off guard. He went for Justin’s legs and swept the wrench, knocking Justin backwards. The man with the pony tail stood over Justin, holding the tork-wrench like a battle axe.

Rachel loved working for the post office. It was good money for one thing. She made a third of what Jim, her husband, the contractor, made, but she was making a major contribution
to their household and family. She paid for the private schools their two sons attended. Joseph, 16, attended Lourdes Catholic High school and David, 11, went to Holy Spirit Elementary. Rachel bought their clothes and all needed supplies: books, folders, and backpacks. She paid for field trips all other activity fees like when Joseph thought he wanted to join the wrestling team. Rachel’s income took care of the cable bill, the internet, and all the phones. She paid for the electricity, the heat, and the water. She fed the family except for twice a month when Jim would take the family out formally, and she covered most vacations. Jim took care of everything else: insurance, vehicles, mortgage, investments—because of Jim they had fluent bank account and an amazing house, but Rachel was proud of her contribution. It was a good job, being a postal worker, and government benefits were nothing to sneer at. She looked good in the uniform too, especially this time of year. She filled out the knee length shorts and tight, sleeveless button-up shirt quite nicely—curvy, but not bulgy—and the postal blue contrasted the deep red color of Rachel’s shoulder length hair that she clipped back behind her ears and brought out the water blue of her eyes. It was an active job, delivering mail, and Rachel loved the exercise. On any given day she’d put in ten to fifteen miles of walking up and down the residential neighborhoods of Rochester, stuffing boxes with bills and birthday cards, junk mail and paychecks, court orders and travel guides. Her day typically began at 7:00a.m. and ended by 3:00p.m. She was generally home in time to greet the boys after school. Add a half an hour of paid lunch—not a bad day, but some days were different. There were sometimes when nothing would go right: Mail would be sorted wrong or loaded on the wrong truck and Rachel would find herself walking the sidewalks at 5:30-6:00 at night. This had been one of those days and it was finally almost over. She had the 900 block of 2nd Street left and then she was done. It wasn’t a real problem at home. Jim did most of his work out of the house. He’d be there for the kids. He’d just have to order out for dinner. As brilliant as Jim was with land development and numbers, he was a mess in the kitchen. He’d probably order pizza, but Rachel hoped for Chinese. She was so relieved that her day was almost over that she walked through the early evening drizzle without her rain gear. It felt refreshing after the day she’d had. Two houses were left: 927 and 929; then she’d be in the jeep heading back to the station.

Rachel had a handful of bills as she walked up the front walk of 927. The interior of the house was dark. She couldn’t remember the last time anyone was home at this address. Rachel was inserting the mail into the black box at the entrance to the porch when she heard a loud crash of breaking glass followed by what sounded like a sack of potatoes rolling across the roof of the porch, and a man in a gray maintenance uniform with a black Mohawk thumped on the ground in the front lawn. His arms were going in strange directions and even though he landed on his stomach his face looked straight up at the sky:

*Oh my God! Oh my God!*

Rachel threw her mail bag down and ran to the man. She stooped down almost touched him, almost felt for a pulse, but the way he was laying like a ragdoll Rachel could tell there’d be no pulse:

*Oh no! Oh God!*
Rachel scrambled through the pockets of her bag to find her smart phone and when she pulled it out she heard the front door of the house open and close. She looked up and saw a shadow of a man standing behind the screened porch door, looking down at her—and she froze. She turned to look at the man lying broken in the lawn. The porch door creaked open and she gasped. Machine stood over her motionless on the steps. He wore a black suit, black shoes, and a black tie over a white shirt. His face was scarred and expressionless behind dark sunglasses. The black Mohawk contrasted his pale scalp, and he stood there.

All that Rachel could think was that she wished she was at home making dinner for Jim and the boys. A debilitating dread welled up in her chest. Machine held out a flip phone toward the dead man with the Mohawk. Rachel desperately rummaged through her brain for a way out of this. Machine pushed a button with his thumb and the phone made a shutter noise. He was taking a picture. He punched a few more buttons and stepped down to Rachel. He held the phone out to her:

911. It’s ringing. Tell them there’s another one upstairs.

And he walked away from her, down the sidewalk, and climbed into a black car. Rachel was ready to throw up when she heard a woman’s voice from the phone:

911 emergency. Who’s calling?

Justin sat in the driver’s seat of the Impala flipped open the ACER Notepad attached to the dash. The pretty, red headed, mail courier was on her knees in the front lawn of 927. She held the flip phone to her ear, but she wasn’t saying anything. She just knelt there staring at Justin. She was probably in shock. The screen of the ACER lit up all white. Words appeared at the top:

Status?

Justin typed into the keypad with his right hand:

Secured.
Anything?
Two other players.
Who?
Unknown. Sending photos.
We’ve established a trace on the objective.

The pretty mail lady was now standing. She was holding the phone toward Justin and the car. She was taking a picture. Justin closed the note pad and looked directly at her. She lowered the phone and started to back up toward the house. Justin started up the Impala, put it in drive, and headed north.
Chapter Seven

Somewhere along Highway 61
Just south of Two Harbors—Same night

There is nothing particularly special about a 1973 Buick Riviera. It held a standard V-8 under the hood, 3 speed automatic transmission, and continuous air flow. Basically the Riviera is Buick’s personal luxury car and Max’s dad loved the thing. Every weekend Max would watch his dad work on the Riviera. He would try to help, which usually involved handing him a monkey wrench or a hammer. It wasn’t much help in retrospect, but Max was nine and he relished the time with his dad, and that time was always spent with his dad under the hood of the Riviera. When his dad died Max took the Riviera as his own. He’s spent thousands of dollars keeping it up and upgrading it from luxury car to military muscle—the thing was like a tank, and as he drove through the armed mob of maintenance men he drove several under the front tires and dragged them with the under carriage while he knocked others through the air and into others like flying shrapnel. The bullets they fired punctured the frame. A single shot hit the windshield and spider-webbed the passenger’s side of the glass. The schoolgirl in the backseat was freaking out and screaming:

*What’s happening?!
Stay down!*

Max plowed through the mob like it was whipped cream. In the rearview mirror he watched men in maintenance uniforms pile into trucks and vans. A lone gunman stood square in his headlights. Max charged him with the Riviera. The fired repeatedly into the front grill and Max accelerated. The front bumper hit the gunman in the kneecaps lifting him up over the hood. He struck the windshield and Max slammed on the brakes, sending him over the front of the car. Max hit the gas pedal and ran over the man like a speed bump—thump thump—and tore out onto the highway, heading north again. In the rearview mirror headlights were following: van after van after truck after truck left the rest area and ripped up the highway in pursuit. The girl in the back seat was reaching levels of hysteric:

*I don’t want to die!
Just stay down!
Who are you?
I’m Max.
Max.*

A black truck with workers hanging out of the bucket like angry hockey fans advanced on the left. Max could feel the vibration of the vehicle’s approach. He cranked the steering wheel and bumped the truck over. The truck swerved onto the shoulder and then back into the lane as though it had only experienced some light road turbulence. The rear side window exploded and the schoolgirl screamed. In the back of the truck a maintenance man had a twelve-gage leveled on the windows of the Riviera. Max swerved left again running into the front corner panel of
the truck driving the truck into the ditch. The truck rolled in and out of the ditch like it was built to do. Max slammed on the brakes:

    Hang on!
    Okay.

Now the truck was ahead of the Riviera. Max leaned out the window extending a .357 Magnum Desert Eagle and stomped on the gas. As the Riviera charged the truck he squeezed the trigger repeatedly. One by one the maintenance men fell from the back of the truck. Max swerved around the right of the truck and shot at the tires. A bullet popped the rear right tire, the truck rocked, and sparks flew. As the Riviera passed the truck Max shot the front right tire. The truck swerved then jackknifed then rolled once, twice, three times before it came to rest upside down in the middle of the highway. Two black vans swerved around the obstruction in tandem—one around the left, the other around the right—and advanced quickly side by side. The repetitious popping of machinegun fire pelted the trunk of the Riviera. The rear windshield took several hits and spider-webbed over. Max swore in Russian:

    Yehbut!
    I’m gonna die! I’m gonna die! I’m gonna die!
    Miss?
    Oh my God, oh my God, oh my God!

The girl’s losing it. Understandable—Max sympathized, but he needed to focus, and focus was hard enough, considering the chemicals floating around inside his head:

    Miss.
    No, no, no, no, no...!
    LADY!

Max was pissed at himself for yelling at her. She was scared enough as it was. He had no idea what the hell was going on and he was certain she didn’t either:

    I’m going to have to ask you to stop that.
    What’s going on? Who are these people?
    I don’t know.
    I’m scared.
    I know.

A van edged up on each side of the Riviera. Max would’ve slammed on the brakes again, but headlights filled the rear windshield. The Riviera was boxed in.

    Molly was struggling with keeping her mouth shut. The man behind the wheel, the man who had rescued her from her kidnappers, needed to concentrate, but she had so many screams bouncing around inside her that she could barely keep from peeing herself. She kept
down as low as she could, but all the gunfire and shattering glass fed her anxieties like kindling causing her to leap out of herself. Every crack of a gun, every plunk of a bullet piercing metal drove to the brink of completely checking out; and she was certain the walls of the backseat of this man’s car would only hold out for so much longer. It was only a matter of time before she’d be hit or taken again. Molly thought about her father. She missed him. She hoped he was okay, but strongly doubted it. And who’s this guy that saved her? He’s like some little army. Whoever he is Molly trusted him for some reason. What choice did she have? He’s the only thing between her and the crazies who took her:

*Miss?*

He’s talking to her again. Why? She hasn’t screamed in at least forty seconds:

*Miss, I need you to do something for me.*

How can he his voice soft and calm? How can he do that? How can he not be losing his mind? It actually helped Molly to keep herself from ripping her hair out:

*What?*
*I need you to lower the back seat.*
*What?!*
*The back of the seat folds down. I need you to reach up behind the left corner.*
*Okay.*
*There’s a latch.*

Molly reached up with her hand and found the latch. There was a canvas loop hooked to the seat. She tried to flip the latch:

*It’s stuck!*  
*It gets jammed up. You really gotta yank on it.*

Molly gave it another couple tries, but she couldn’t see what she was dealing with from the way she was crouched down, so she climbed up to get a better idea of what she was dealing with. There was a van on each side of the car and a vehicle approaching from the rear. She squeezed the back of the seat with her left hand to brace herself and yanked the latch with her right. The right side window exploded in a hail of glass. Molly screamed and fell to the floor pulling the back of the seat down with her:

*Stay down!*  
*Okay.*

The van on the right crashed into the car, driving it into the left van, which crashed it back into the right van:
Reach into the trunk and grab the sawed off.
What?!
Reach into the trunk and grab the sawed off!
What the hell is that?
It’s a shotgun!

Molly climbed into the trunk which was full of guns: Handguns, rifles, machineguns, and shotguns. Who is this guy? She was grabbing around in the dark trying to locate the sawed off when the car was struck from the behind. Molly and many of the guns fell out of the trunk into the back seat. Molly yipped. She shuffled through the guns and found the sawed off and threw it into the front seat:

Here!
Thank you!

Molly lay herself flat over the pile of guns.

Max grabbed the sawed off shotgun—a Remington 12 gage double barrel from the passenger seat:

There should be a case of shells.
Shells?
Shotgun shells. Can you try to find them?

A box of 12 gage shells flew up into the passenger seat:

Thank you.

Max flipped the box and scattered the shells over the seat:

Miss?
What?
This is going to be very loud. I really need you to stay down now.
Yeah, I get that.
And cover your ears.

Max held the shotgun out at the passenger side window. He squeezed the trigger and the gun exploded causing his ears to ring. The girl screamed. The window was gone. The driver of the van was grinning. Max squeezed the trigger again and with another explosion of the gun the driver’s head was gone. The van lurched, flipped end over end, and fell out of view. The vehicle in the rear, a black pickup, accelerated, and replaced the van. Max flipped the shotgun and it folded open. While he controlled the Riviera with his left hand, he unloaded the empty shells from the shotgun and stuffed two new shells into the barrels with his right. The van on the left swerved into the car and sent it into the truck causing the truck to swerve onto the shoulder.
The side door of the van was open and three maintenance men, one standing, two kneeling had machineguns lowered on the Riviera. They began to fire. Max crossed his arm over and out the window and fired twice. Two of the three men fell onto the highway. The third fired into the car. Pieces of upholstery flew into the air. The interior of the car was snowing with fluff and stuffing. Max threw down the shotgun and picked up the Desert Eagle. He fired the handgun repeatedly and the third maintenance man fell back into the van. Max slammed on the brakes again, put the Riviera into park, and climbed out. Up ahead the truck and the van screeched to a halt, fishtailing in opposite directions, forming a road block. Men in gray uniforms poured out of the vehicles like ants. Max reached into the back seat. The schoolgirl backed away from him.

_It’s okay._

Max sifted through the arsenal pile and pulled out another rifle, a Bernardelli B4 semiautomatic Tactical Combat Shotgun, made sure it was loaded and backed out of the Riviera:

*Wait, where are you going?*

*Nowhere. Stay here. And—*

*Stay down?*

*Please.*

Max went out to the front of the car and started shooting. His dropped men in uniform like they were gilded worker bees. He shot out tires and windows. The return fire was depleting. Bullets zipped by his head, the chunk chunk chunk of bullets puncturing the hood of the Riviera rang out, and the girl was screaming, but Max continued shooting until the opposition ceased. He looked at his car and frowned. He put his hand on the hood which was hot:

*My car.*

Headlights appeared in the distance—single headlights and five motorcycles appeared out of the darkness, advancing in high pursuit. Max jumped in behind the wheel:

*Motorcycles? Who the hell are these guys?*

Max turned around in the seat and stuck the barrel of the Bernardelli B4 against the rear windshield:

*Cover your head!*

*Shit!*

With a loud pop the rear windshield exploded. Beads of glass rained all around the girl on the floor. Max fired up the Riviera, put it in drive, and pushed the pedal to the floor. The rear tires spun on the pavement, squealing and throwing smoke before grabbing traction, and speeding toward the ruins of the vehicles ahead, the roadblock of corpses and debris:
This is going to be rough!

Max ran over three dead maintenance men before crashing through the center of the barricade sending the van and the spinning in opposite directions. He looked in the rearview mirror. The motorcycles weaved effortlessly around the bodies on the highway and were rapidly gaining on the Riviera. Three of the motorcycles approached side by side. The other two followed only a short distance behind. As soon as they were close enough, Max once again hit the brakes. The middle motorcycle slammed right into the rear of the Riviera. The bike crashed into the hole where the rear windshield used to be and the girl screamed. The rider flew over the top of the car and rolled over the hood. The other two flew by and skidded to a stop a hundred feet up. Max picked up the sawed off and slammed the car in reverse. The two motorcycles in the rear split around the Riviera. As they passed, Max fired the sawed off out the passenger side window, catapulting the rider into the ditch. The bike wobbled for thirty feet before tipping on its side—skidding and spinning for another fifty feet throwing a shower of sparks in its wake. Max threw the Riviera into drive and sped toward the remaining three cycles that were speeding toward him, and the bike that was stuck in the rear windshield broke free and crashed to the pavement. Bullets persistently added more holes into the body of the Riviera and Max felt sick. If his dad were alive he’d have been crying. Max charged forward into the bikes. Two reared to the right and one to the left. Max easily took care of the one on the left through the driver’s side window and continued up the highway. The remaining two motorcycles turned back around:

Persistent fuckers.

Max held the gas pedal to the floor and was reaching speeds close to 110mph. The motorcycles couldn’t keep up, but they wouldn’t give up either:

Fuck it.

Max hit the brakes and the Riviera slid sideways. He jumped out of the car and dug into the back seat. The girl looked beat-up and exhausted:

What’s happening now?
Gimme a minute.
Right.

Max yanked a military green canvas backpack from the trunk and walked out in front of the car to directly face off with the bikers who began to slow their approach and then stop about a hundred yards away. Max dug into the bag and pulled out two World War II Fragmentation grenades. Max started walking toward them. They began shooting. Bullets ricocheted off the pavement and hit the side of the Riviera:

Goddamnit!
Max pulled the pins from the grenades and lobbed them toward the bikers. The explosions occurred several yards away from the intended targets, but the shrapnel dispatched them effectively: shards of metal impaling flesh and ripping through the internals. Max stood waiting, expecting more assailants in maintenance uniforms, but there was nothing, so he reached into his jacket and pulled out a pack of cigarettes. As he lit up the girl sat up in the back seat:

_Can I come out now?_

Molly brushed off beads of glass. Her arms were cut, her back was sore, and her face bruised. She swept her hair from her face and climbed from the car. She stumbled over and stood beside Max, looking at the aftermath. What just happened? She was grateful to be alive, but she felt displaced. The man, Max, stood smoking. Who was he? Why was he helping her? Whoever he was, she had the distinct feeling that if she wanted to see tomorrow, she’d better stick with him. The world was blurry and spinning. Molly tried to stop herself, but she buckled over and vomited. She stood there hunched over with her hands on her knees:

_I’m sorry._

_Don’t be._

After a couple deep breaths Molly’s head was clear enough for her to stand. Max gently touched her shoulder:

_We should go._

He helped her to the passenger side of the car. Molly appreciated his assistance. Even though her head had cleared the ground continued to rock beneath her feet. Max opened the passenger door and she climbed into the seat. Max shut the door and walked around to the driver’s side. Molly watched him reach into the backseat and shove all the weaponry into the trunk. When he got behind the wheel and started up the car she wondered where he came from, what his back story was. He turned and looked at her:

_What’s your name?_

_Molly._

At that moment she was pretty sure that she would follow him wherever he went.
Chapter Eight

Meanwhile
Another time and place

The last thing Justin could remember was a big fucking needle. He’d been strapped to a reclining lab chair. Not because he was dangerous, though he was. He was there voluntarily. He’d stepped up for a new experiment that he had no understanding of—some nano-technology nonsense that he didn’t care about. Justin volunteered out of loyalty to his employer, Morning Star, an independent contractor with interests in the middle east, central America, and Russia to name a few. On the home-front Morning Star handled corporate issues, hostile takeovers and such. If you’re a high political figure and you need foreign support you call Morning Star. If you’re looking to overthrow a third world colony you contact Morning Star. And on a smaller domestic scale if you need to remove a child molester from your district—Morning Star. Justin had been with Morning Star since serving in Pakistan in 1999, when he assisted Pervez Musharraf and the Pakistan to army overthrow the government, and has been a dedicated employee ever since. Morning Star took care of Justin. They took care of all his needs, and so when volunteers were sought, he gladly offered himself for the experiment. This pleased his superiors greatly as he was their number one candidate, and now he was strapped securely to what was the equivalent of a dentist’s chair surrounded by white-coats.

Tolya Sokolov, a lab technician, had only been with Morning Star for three months. He was recruited right from The Lomonosov Moscow State University upon graduation. He was the top of his class, specializing in genetic enhancement and nano-technology. He was third in the order of ranking of Morning Star’s Machine Project—an experiment where qualified candidates were to have super computers the size of molecules injected into their brains in an attempt to develop controllable assassins. If it worked the subjects would be operated remotely from Morning Star like radio controlled cars. It was a dangerous prospect with potentially horrendous consequences and Tolya was proud to be a part of it. He rolled a stainless steel table alongside Subject Zero who was strapped to a lab chair. The tray on the table held five different syringes. Larisa Zlobin, Tolya’s direct superior, walked into the lab and Tolya’s temperature rose about three degrees. Larissa was responsible for recruiting him from Moscow and he fantasized about her regularly. Larisa picked up a chart:

How are we looking here?
Good. He’s stable. Strong.
Subject Zero: Justin Brodsky—
He’s a Czech.
Yes. Very impressive resume.
He’s the real deal.
Real deal?
I’m trying to Americanize.
I see.
Larisa set the chart down and walked up to Justin:

*How are you feeling?*
*Good.*
*Are you comfortable?*
*I’m good.*
*Let’s begin.*

Tolya picked up the first syringe, injected its contents into Justin’s neck, and waited. Justin’s black eyes began to shake and flutter. They panned the room back and forth, and then rolled up into his head:

*He’s out.*
*Proceed.*

Tolya injected the next two needles into Justin’s neck just under his jaw waiting two and a half minutes between shots. The next injection went directly into Justin’s left temple. Justin began to convulse against the restraints. Tolya and Larisa stepped back and after thirty seconds the convulsing calmed and then stopped. Larisa penned a few notes on the chart and then nodded to Tolya:

*And finally.*

Tolya had to release the strap around Justin’s head for the final shot. He lifted Justin’s head and held his chin to his chest. Tolya inserted the needle at the base of Justin’s skull and stepped back again. Larisa stood watching with the chart in her hand.

After forty five minutes of nothing Tolya checked Justin’s vitals:

*Heart rate is normal...no wait...heart rate is steadily increasing!*

Justin’s eyes popped open wide. His eyes shot to Larisa and then to Tolya. His right arm strained against the black strap. His veins bulged out and the strap broke. Justin grabbed Tolya by the throat.

The last thing Justin could remember was a ridiculously oversized syringe, the kind farmer’s use on cattle, going into is neck, and now he was standing in a hospital gown in one of Morning Star’s experiment labs with two dead white-coats laying at his feet and several others, armed, and circling him.

Nine years later Justin pulled the Impala over onto the shoulder of Highway 61 just north of Duluth and south of Two Harbors. What he saw reminded him of the War in Chechnya when Chechen Republic of Ichkeria fought off the Russian Federation using guerilla warfare, dead bodies everywhere. It was ground zero. The Highway was littered with turned over vehicles, twisted metal and broken glass, and dead men in blue shirts and darker blue pants.
They were all wearing the same uniform—an army. As he walked around the debris he kept count: 37 dead. In the ditch he found a headless biker. The agent had been busy. There was movement on the road. A biker limped around the devastation. He picked up a motorcycle and tried to kick start it. After six tries he climbed off and pushed the bike to the pavement. Justin watched from the shoulder as the limping biker tried another motorcycle and gave up after three attempts. The biker threw the cycle to the ground, looked up, and noticed Justin watching. Justin stood motionless, unsure of what to expect, prepared for anything. The biker looked up and down the highway, and then limped over to one of the dead bodies in the road. Justin watched as the biker bent down to pick something up. The biker started limping toward Justin and when he was about twenty yards away he pumped the shotgun. He held it at waist continued limping toward Justin. Justin reached inside in jacket and pulled out a 9mm with a titanium alloy silencer and shot the biker in the forehead. The biker fell straight back and hit the pavement flat. Justin tucked the 9mm away.

The dead biker wore the same blue uniform as the rest of the casualties. Justin rifled through the biker’s pockets finding nothing, but a business card with nothing, but a phone number—Morning Star’s mainline. He kept the card and headed back to the Impala. Inside the car he flipped the notepad open:

_**Status?**_

Justin tossed the business card onto the dashboard. He punched a few keys on the keypad and Google popped up on the screen. He typed in a general search:

_**Identifying poisons.**_

Adil Faheem, Module Lead of Morning Star’s ongoing Machine Project, sat in front of a bank of computer monitors. For the past five months he’s been tracing all movement and activity of Subject Zero, the first Machine in the program—the first failure as well as the first success. The objective of the project was to use nano-technology to genetically enhance field operatives, to make them smarter and stronger. The micro computers that were injected into the brain were directly linked to the Morning Star information center and ideally the agents would be traceable and controllable. But it didn’t work out that way. They became stronger and much smarter, but they were uncontrollable—the computers sent plenty of information out, but blocked any from coming in—and they became a lot more violent. Except for Subject Zero. Most of the ten subjects went rogue, developed drug habits, went on murder sprees—three of them died within the first 24 hours, their brains overloaded and shut down completely—but Subject Zero retained his loyalty to the company. He held on to reason. He couldn’t be controlled as planned, but he didn’t need to be. He followed orders with vigilance and dispatched his duties with skill and proficiency. He was the most efficient field operative that Morning Star had in their employ and the experiment only made him keener. Of course, this was after he destroyed half the lab, killing five personal with his bare hands. Three of those five were armed. It took three shots of M99, Elephant Tranquilizer, to bring him down. He was the
star assassin for Morning Star, and arguably the most dangerous, and it was Adil’s responsibility to keep track of him.

Project Director, Hadriel Botvinnik, walked into the information center with a Styrofoam cup of coffee and a white chocolate/ macadamia nut cookie. Director Botvinnik was military trained in Afghanistan during the cold war. He specialized in coercive interrogation. Director Botvinnik knew ways of hurting people the devil never thought of. He handled business like a political sociopath—calculating and ruthless. Adil resented him for the cookie:

    *Director Botvinnik*
    *Any news Mr. Faheem?*
    *He hasn’t responded in hours, but there’s something you should see.*

Adil punched in a few commands and the middle monitor switched to video:

    *This is six hours ago.*

Adil pushed play. On the screen was a black and white tiled bathroom with claw footed bathtub. Adil recognized the bathtub. It was much the same as the bathtub in the house he grew up in. A very nice tub:

    *This is Subject Zero’s point of view—we’re seeing everything he sees.*
    *I’m aware of the definition.*
    *Of course. This is the missing agent’s house.*

On the screen a hand holding a telescoping baton fishes an object out from behind the toilet. Another hand picks the object up and holds it to the camera. A hypodermic syringe:

    *Right there.*

Adil froze the image on the screen:

    *He found the needle, which is no surprise.*
    *A girl overdose in the tub the night before.*
    *So, why are you showing me?*
    *Watch this now.*

Adil let the recording play through:

    *Why does he keep the needle? He never mentioned it in his report.*
    *I’ll tell you why.*

Adil waited for him to finish. He really hoped he could leave soon. He was so hungry he was thinking about eating his hand. Adil rolled back in his chair to give the director some space.
Director Botvinnik’s eyes darkened with concern. Cookie crumbs speckled his shirt. Adil wanted to punch him. Director Botvinnik leaned in closer to the screen:

*He’s working for himself.*

Justin pulled the syringe he found at the agent’s house from his jacket pocket. He scrolled down a long list of fatal poisons and stopped when he found what he was looking for. He pulled the plunger from the syringe and sniffed the empty tube. The notepad dinged and the main screen popped up:

*Report in.*

Justin returned the syringe to his jacket pocket, closed the notepad, started up the Impala, and continued north on 61 weaving through the wreckage.
Chapter Nine

Rochester, MN
Before—

Annie woke Max up with a kiss. It was magical, his favorite part of everyday. It was reminder to him that life was worth living. As disappointing and tragic as it could be, it was worth living. There was hope, and Annie embodied that hope. She was, without question, an angel, Max’s savior:

Good morning Princess.
Good morning my liege.

Annie buried her face into his neck:

Let’s stay in bed today.
Stay in bed?
All day! We’ll turn the phones off and just lay here together.

Max ran the idea through his head. It could think of nothing he’d rather do on such a day. Rain was falling steady. Thunder rumbled in the distance. Cool air blew in through the bedroom window. It would be the perfect day to lie naked with Annie. Exploring all of his favorite parts of her, but he was scheduled to be in Minneapolis by 9:00am and that meant he needed to be on the road twenty minutes ago:

I’d love to sweetie, but—

Annie clamped her hand over his mouth:

No, no, no, no, no, don’t say it.

Max lifted her hand from his mouth:

I’m sorry princess, but I really need to go to work.

Annie rolled over on top of him:

Nooooooooo! Stay with me!

She leaned down and kissed his neck and then whispered in his ear:

Pleeeease.
Okay.
Max grabbed her face and kissed her long and hard.

A semi drove by and it jarred Max from his memory. He was sitting behind the wheel of the Riviera smoking cigarettes in the parking lot of the Whispering Pines Motel just outside of Silver Bay. He was parked outside room #11. The girl, Molly, was inside. He’d rented a double, so there were two beds, but he felt it safer for her if he were outside watching the door. He’d checked all the windows and made sure everything was relatively safe. Molly sat on the edge of the bed closest to the door. She looked lost:

*You should be safe here for a couple hours.*
*Where will you be?*
*I’ll be right outside in the car.*
*You can’t stay here?*
*I’ll be safer if I’m out there. No surprises.*
*Okay.*

Molly looked sad. She looked like Annie. Max reached behind him and pulled a Walther semi-automatic 9mm Luger from his belt. He checked the clip to make sure it fully loaded and then he handed it over to Molly:

*Here, take this.*
*What?*
*It’s got 16 shots and it’s ready to fire.*
*What am I supposed to do with this?*
*Don’t worry about aiming, just point and squeeze the trigger—squeeze the trigger, don’t pull it.*
*But why—I don’t want this.*
*Just keep it.*
*No. Stay.*

Max felt like his heart was being strangled. Molly held the 9mm out to him:

*Please.*

Max closed her fingers around the pistol’s grip:

*Listen to me Molly. I am not going to let anything happen to you. I will be right outside that door. I want you to take this in case I need back-up. You understand what I’m saying?*

Molly nodded.

The digital clock on the radio said it was 2:27am. Even though he was on high priority alert the discomfort of alcohol withdrawal was creeping in. Max was starting to tremble, his
hands were starting to shake, beads of sweat were forming around his collar and at his temples, and his muscles felt like they’d been tenderized. He had about a quarter gram of speed left, but he was trying to save it for game time, but he didn’t think he’d last that long. The physical effects of withdrawal can be overwhelming, but the mental stress is intolerable. He’d told Molly that he’d need her for back-up when the time came, but what he should've told her was to take out as many as she could, but to save the last bullet for herself. He cursed in Russian:

*Dairmo!*

Max popped the glove box of the Riviera and pulled out the last of his Meth. There was a little less than he had hoped, but it would work. He dipped his fingers into the little zip-lock and then snorted the powder up his nose. He thought of Annie in the bathtub with the needle stuck in her arm. Max preferred the method of snorting. He liked the burn in his nostrils and the aspirin taste as it ran down his throat. Annie liked needles. She said it was a cleaner high. Max climbed out of the driver’s seat and stood in the night air. A cool breeze was blowing off of Lake Superior. It felt good against his skin, and a cool calm wrapped around him—clarity returned.

He lit another cigarette and walked out to the Highway. Max looked south and saw nothing but darkness. He looked north—darkness. Not much concern for light on the north shore. He stood at the edge of the Motel’s drive and the road smoking his cigarette, and trying to sort out the events of the last 24 hours. Annie was dead. He’d walked off a job in Stillwater and Annie was dead. And now there’s this Molly, this schoolgirl who couldn’t be more than sixteen years old on the run from some...that’s where he drew a blank. What was happening to this poor girl? Max was happy to protect her, whoever she was—and the chase and the battle—all that brought him back to Chechnya. It reminded him of having purpose, fighting for a cause, not just killing for corporate gain—it made him feel alive again. In Chechnya, he fought alongside a people defending their in dependence, and even though he was a paid contractor, he felt the importance, and believed in the cause. Now he was protecting a young girl from an unknown evil and he felt the same. He felt redemption flowing through him. For the first time in 24 hours Max knew he was doing the right thing and that the universe had assigned him this mission, a mission that he was prepared and willing to die for. He felt enlightened.

And Annie was dead.

Annie was gone and Max had to get that shit out of his head or he was going to fail. He loved her very much. Of that he was certain, but everything is transient and temporary—life, love, logic, truth—the only constant is regret. Regret never leaves. That’s where methamphetamine comes in. Max flipped the cigarette butt into the road and walked back into the motel parking lot. He looked into the driver’s side of the Impala to check the time: 3:15am, time to go. He went to room eleven and knocked lightly on the door:

*Molly, it’s Max. I’m coming in, okay?*
She didn’t respond. Max could hear canned laughter from the television inside the room. He slid the room key into the deadbolt and unlocked the door. He knocked again as he pushed it open:

_It’s me, Molly. It’s Max. We should get moving._

The wood of the door jamb splintered right next to his ear simultaneously with the blast of the Walther. Max jumped back out of the room and drew the Desert Eagle:

_Molly?!

Still no response. Max kicked in the door and charged the room like a true soldier. Molly was sitting on the edge of the bed, the same spot she was sitting when he left her. She held the 9mm with both hands with her arms straight out, and the gun pointing at the door. She was shaking. Her eyes were wide and terrified. Max set the Desert Eagle on the table by the window:

_Molly, it’s okay._

Max eased the Walther from her hands. Molly looked up at him. Her eyes were wet, her cheeks were streaked. Max lightly touched her shoulder:

_It’s time to go._

Molly fell forward and wrapped her arm around Max’s waist. She buried her face into his stomach. Max put the 9mm back into his belt. He hugged her back and let her to sob into his shirt. If it wasn’t for the Meth, he thought, he’d be sobbing with her.
Chapter Ten

Undisclosed location
Same Night

The air in the lower levels of Morning Star is synthetic, a mixture of pure oxygen and pure nitrogen—the same mixture used in cryogenic tanks and vaporizers. There is a continuous flow of recycled air blowing in from floor level vents at a constant temperature of 20 degrees Celsius, the cleanest and safest air available on the market. Director Botvinnik thought it an absurd concept to manufacture air. Not as absurd as using microscopic robots to level the playing field of international commerce, but a ridiculous notion just the same. He was on his third cigarette watching Subject Zero television on the Westinghouse 40 inch LCD flat screen that hung on his office wall. Zero was on a highway somewhere in northern Minnesota. Dead bodies were scattered everywhere. Dead soldiers. His soldiers. Subject Zero searched the pockets of the fallen, looking for a connection. In an upside down van he came across a soldier holding on to life, and holding on to orders. He scrambled for a weapon. Subject Zero shot him before he found one. Director Botvinnik stamped his cigarette out and smiled at the idea that he was likely corrupting the integrity of the synthetic air. With a remote control he advanced the footage forward. Another soldier, a biker, was shot and killed. A line of red ran from a black hole in his forehead. Director Botvinnik continued advancing the video until he saw a computer screen with a list of fatal poisons. He stopped it and shut the Westinghouse down. Morning Star headquarters was full of Westinghouse flat screens. There was one in every office. They lined the hallways and displayed news stories from around the world, global climates, and financial reports. Director Botvinnik wondered why Morning Star hadn’t yet developed its own television. It would seem that even the world’s chief antagonist had contract out certain tasks.

Director Botvinnik sat down at his desk and pulled a bottle of vodka and a glass from a lower drawer. He filled the glass half full and drank it fast. He held his breath against the burn. He filled the glass again and returned the bottle to the drawer. Then he lit another cigarette and leaned back in his chair—sipping the vodka and considering the day he’d kill himself. It wasn’t a matter of if, but a matter of when. It was inevitable, expected. From the middle desk drawer he pulled his Sig Sauer P-250 9mm, a gun he brought with him from the Ukraine. He pulled the slide back and released it—chuh chink—setting a shell into the barrel. He stuck the barrel under his chin and then in his mouth. He squeezed his eyes shut and envisioned the event, the lack of recognition he’d receive, the unmarked grave he’d be dumped into. Director Botvinnik placed the gun back in the drawer:

Not today.

Justin climbed out of the Impala and walked up to the front door of District Attorney Richard Campbell’s estate. He wasn’t sure what he was looking for, but he knew there was something. The interior of the house was lit up. The door was slightly open and when he knocked it creaked open further:
Hello?

He let the door swing all the way in. He had a clear view of the entry way, a grand staircase, a large living room with a fireplace to the right, and a hallway that ran down the left side of the stairs. It looked like every light in the house was on:

Mr. Campbell?

Justin took a few steps into the house:

Mr. Campbell, I’d like have a word with you.

He went into the living room and from the look of it, not a lot of living went on in there. Everything was white and gold. A white leather sectional sofa that looked as though it had never been sat in. A long glass coffee table with gold candle sticks with unlit candles at each end. In the middle of the table sat a pile of travel magazines deliberately askew to give the impression of use. Directly in front of the sofa, a white fireplace with gold accessories. A gold plated screen for containing sparks and flying embers, a gold shovel and poker—across the white mantle of the fireplace sat three gold picture frames: each of a young red headed girl. Justin knew Campbell had a daughter, this had to be her:

Hello?

The only window in the living room looked out the front of the house and on to the circle drive. A modest black Town Car and a gray Chrysler 300 were parked off to the side at the tree line, almost in the woods. There was no movement, no one was around. Opposite the front bay window another hole in the wall led to a dining area with glass hutches filled with expensive china, a long table with more gold adornments: candle sticks and a center piece of gold painted flowers and fruit. The dining room led to a state of the art kitchen which led to a long hallway leading to the front door and the grand staircase. From the hallway Justin could an electrical hum. Another hallway, an unlit hallway, broke off to the right and as he advanced down that hallway the hum grew louder and sounded more like a groan. At the end of the hall was a door cracked slightly open spilling a shaft of light. The groan was coming from behind that door. The closer Justin got the stranger the noise sounded. It came it waves, like it sounds when you’re trying to start your car and the battery is almost dead. Justin pushed the door open and found District Attorney Campbell hanging by his neck from the ceiling fan. His tie was wrapped around his throat. The other end of his tie was wrapped around the fan which had wound the tie up like a spool, lifting and pulling the District Attorney into the fan blades. The whirring groan was the fan struggling to get through, or by, the Campbell’s face. Justin pulled the chain and turned the fan motor off. He stood staring curiously at the body hanging from the ceiling. He wondered what it must be like to be affected by such things, to feel, to be human. The office was all over the place. Books had been pulled from a shelf and scattered over the floor. Papers had been tossed. Lamps had been tipped. A wall safe behind the desk had been opened, its contents removed. Justin went behind the desk and felt something snap under his foot. He had stepped
on a lipstick case. He picked it up from the floor and pulled the cap off revealing a USB Drive instead of lipstick. Campbell’s computer had been dumped over onto the floor. Justin set it back up and turned it on. It had been undamaged. Once it was reset he inserted the lipstick USB. One file popped up. The name of the file: Morning Star.

Thoughts popped in and out of Molly’s head. Electrical impulses, moments of her life, flashed on and off like images on a video screen. She couldn’t hold onto any of them. They all seemed distant, just out of reach like they belonged to somebody else. The ache in her chest was starting to fade and the fear was gone. She couldn’t remember why she’d been afraid in the first place.

Adil Faheem knocked on Director Botvinnik’s office door and entered. The knock was really more of a courtesy move to let the director know he was coming in. He felt no need to wait for an invitation:

*I’m sorry to intrude.*

Botvinnik sat behind his desk with his back to the door. A handgun lay next to a bottle of vodka. Adil could smell cigarette smoke. Botvinnik spun around in his chair with a glass of vodka in his hand. He looked tired:

*What is it?*
*He found his way to Campbell’s house. Campbell’s dead.*

The director closed his eyes and took a deep breath through his nose. Adil stood waiting. The director poured more vodka into the glass:

*How?*
*Suicide.*
*Of course.*

Adil hated these interactions with Botvinnik. They were always slow and choppy. Two or three words get said and then wait for a signal to continue. Life in the underground offices of Morning Star moved along in the director’s time, no one else’s—certainly not Adil’s—and so Adil continued to wait impatiently. Director Botvinnik drank vodka and stared at the ceiling:

*Is that it?*
*He’s got the USB.*

Botvinnik stopped breathing. He stared forward through Adil. He lit a cigarette and Adil wanted to scream. He’d been trying to quit for weeks and work was the only place he could go without obsessing over it. After what seemed like a lifetime Botvinnik snubbed the cigarette into an ashtray:
Wipe everything.
I’m sorry?
Shut it all down. Pack it all up. Code blue protocol.
Sir?
We’re moving.
Yes sir.

Adil turned to leave the office, more agitated than concerned. It would be another three hours before he’d have a chance to eat. From behind him:

*And initiate Project M2.*

Adil turned back:

*M2 sir? Do you really think—?*
*Immediately.*

Adil nodded and left the office.
Chapter Eleven

Another World
A lifetime ago

The temperature in Chechnya was 37 degrees Celsius and even though Max’s suit was designed for such weather it did very little in the way of comfort in such heat. Sweat ran down his forehead and stung his eyes. There was a thirty percent chance of rain, which was laughable. Even if it did rain it would only last for minutes and increase the humidity. Max hated summers in Chechnya. Max laid in the on the side of the road. Gunfire bounced off the trees all around him, soldiers barked orders at each other in Russian, tanks moved along down the road, surrounded by armed Russians searching the area, firing randomly into the trees. Max laid as still as he could, holding his rifle close to his chest. He’d been sent from the interior of the woods to scout the situation and now he was stuck hiding in the warm grass of the ditch. He had no way of communication back to his troop, so he laid there waiting for the Russians to pass and he knew they would. This was just a routine drive by. Twice a day they went up and down the road like looking for stragglers, rogue rebels in the woods, and displaying their dominance. The tanks on the road stopped. A man from the road yelled in Russian:

_Check the ditch! I saw something move._

Max stopped breathing. And young Russian soldier walked through the grass just feet in front of him. Max braced himself and when the young Russian spotted him, he hit him in the face with the butt of his rifle. The young man hit the ground rolling and ended up right back on his feet and ready to fight. Soldiers from the road shouted Russian things at each other and charged into the ditch. Max was locked in hand to hand with the young Russian who came at him brandishing his M92 combat knife. He swiped forward and back, Max jumped back just escaping the slash of the blade, grabbed and twisted the young Russian’s arm, and drove his elbow into the fold snappign the arm backward. The young Russian screamed. Max punched him in the throat and let him fall to the ground. When he turned back he saw that he was surrounded. He threw his hands in the air and shouted in Russian:

_Yah cdayouce! Yah cdayouce!_

And he knew how the young Russian must’ve felt when the butt of a Kalashnikov AK-74 assault rifle cracked him in the face.

When the flashback finally faded Max was crouched down in the upstairs hallway of his and Annie’s house shaking and sweating. Annie was sprawled out at the bottom of stairs, unconscious with a line of blood running from her ear canal:

_Annie?_
The water in the shower was running cold so as not to steam up the bathroom. Max emptied the rest of the Meth onto the sink. It was more than he expected—a happy accident. Molly was asleep in the next room. It was imperative they leave as soon as possible, but she had cried herself to sleep and Max wanted to let her rest a little. She needed it. She’d been through more in the last few hours than anyone should have to go through in a lifetime. To Max it was like home, just another day. The fighting, the car chase, the gunfire—it was like Mondays in Chechnya. Not a big thing. All part of the day to day traffic of growing up in a world of civil unrest—Darwin in effect. Max was comfortable in such surroundings. He felt useful, sometimes even tranquil. It was his calling, what he was meant to do and be a part of—and he was trained for it. From the moment he could stand and hold a gun his training began, but Molly was a sixteen year-old-girl who went to a private catholic school. She had a home and a dad and a boyfriend. She went shopping with her girlfriends and complained about book reports due and geometry tests. She got up every morning, had breakfast, listened to the radio; and every night she text messaged, hung out on Facebook, and ignored the news. This was not a life she’d ever known, or was ever meant to know, and Max was determined to get her away from it, to get her back where she belonged. He wasn’t there for Annie when she needed him most and he lost her. He’d be damned if he’d let the same thing happen to Molly. He used the key card from a hotel in Stillwater to form the speed on the sink into a long straight line. He pulled a twenty dollar bill from his front pants pocket and rolled it into a straw. He snorted half the line up his right nostril and the other half up his left.

Back in the Impala Justin flipped open the notepad. A highway map flashed on the screen and a red light appeared in the area of Silver Bay. He shifted into drive and drove away from the Campbell estate heading north on 61.

The nine iron was Director Botvinnik’s favorite golf club. He appreciated its versatility. It worked as a short distance driver—you could get a nice straight chip out of the rough—it worked as an adequate sand wedge, and made for a fine weapon. One good swing could crack a man’s skull open like a piñata. Botvinnik swung the club like a baseball bat and smashed the Westinghouse flat screen. He shoved the Packard Bell PC off his desk and onto the floor. One swing smashed the monitor. He brought the club down on the computer again and again like he was clubbing a baby seal.

Max let Molly sleep while he tried to develop a plan. She was curled up in the fetal position. He tried not to think of her as a woman. She was a stunning young lady with strawberry blonde hair and the face of a glamour model, but she was sixteen and she was in some unexplainable trouble. She’d told Max everything she knew—that she was late getting home, as usual, only to find her father being held by men in blue shirts, and then they took her. Not much to go on. Richard Campbell, her father, was the local District Attorney and certainly the DA would have plenty of enemies—and a kidnapping wasn’t out of the question, but an army for a young schoolgirl? It didn’t make any sense. There was a sudden shot of pain in the back of Max’s neck. He rubbed it with his hand and felt something he’d never felt before. There was a lump and it was warm to the touch—electric blanket warm. He went into the bathroom and tried to get a look at it in the mirror. The lump was about the size of a nickel and stuck out
about two millimeters. He grabbed it with his fingers and found that he could move it around a little. He leaned in closer to the mirror and froze. A light red glow shone through his skin. He turned the bathroom light off. A round red light about the size of a nickel reflected in the mirror:

*Cueen Mahterie*

He flipped the light back on and leaned over the sink, breathing heavy—holding back a scream. A tracking device—they put a fucking tracking device in his neck! What did he expect? They owned him:

*Fuck it.*

Max reached into his inside jacket pocket and pulled out a pen knife. He unfolded the tiny blade and held it in the flame of his lighter to sterilize. He wiped the black from the blade onto one of the motel towels and grabbed the device with his left hand and pulled it against the skin of his neck as far as it would go. He took the blade and sliced an opening in his neck the length of the diameter of the disk. He clenched his teeth and growled against the pain. Blood flowed down his back. He should’ve had a towel ready. He pinched and pushed the device out and it fell into the sink. He grabbed a towel and pressed it against the opening. Max wished he’d saved some of the speed to sprinkle on the wound. Meth can be an effective numbing agent. A wave of nausea overtook him and he leaned over the sink gagging and heaving. He breathed in deep through his nose and turned on the cold water. He splashed the water in his face, over his head and through his hair. Blood ran from the cut in his neck. Droplets fell into the sink, mixed with the water, and swirled down the drain. When he felt he could straighten up he splashed his face and looked in the mirror. Annie was standing behind him watching.

She looked sadder than ever. Max jumped and whirled around. The bathroom was empty. He turned back to the mirror. Annie put her hand on his shoulder:

*Max.*

Max turned again, finding nothing, but towels on the wall and a small corner shower stall. In the mirror Annie wrapped her arms around his neck and rested her chin on his shoulder:

*Max, I miss you so much.*

Her face was white, her eyes dark and sunken, and her lips were purple. Her hair was slick, pasted to her forehead and cheeks, and dripping water. Max tried to touch her bled white arms:

*Annie?*
His hand went right through to his collar bone. He could feel her, but he couldn’t touch her. He almost turned again, but he thought sight of the empty bathroom might burst his heart:

_Annie, I’m so sorry. I should’ve been there._

She pressed the side of her face against the side of his. Max felt as though he was being strangled in his chest:

_I love you so much, Annie!_

Annie put her lips to Max’s ear:

_It’s not your fault._

Tears began to streak his cheeks and Max’s chest started to heave as the inner sob escaped, no longer willing to be contained:

_I couldn’t save you, Annie. I couldn’t fucking save you!_

_Max, it’s not your fault._

_Oh God, Annie._

_You can save her, Max._

_Annie!_  

_Save her, Max._

_I can’t stand being without you, Annie! It’s too hard…_  

_Save her._

Max bowed his head. The grief and the shame overwhelmed him. He watched as his tears, mixed with blood and water, and splashed into the sink. Annie rubbed Max’s scalp. He loved that more than anything. Her touch was the only thing that ever calmed him:

_Max, you’re my hero. You’ve always been my hero. You’re my soul. It’s not your fault. You have to take action. You have to save her. You’re too good of a man to do otherwise._

_Annie, I’m not. There are things you don’t know…_  

_Shhh…Max, I know. You are a good man._

_I’m not._

_You are. Save her. He’s here._

Max couldn’t feel her touch anymore. He looked in the mirror, but she wasn’t there. He whirled around:

_Annie, wait. Annie!_
She was gone. All that was left was the water that fell from her hair into his shirt, or maybe that was his tears:

*Aw Jesus, Annie...*

He sucked deep up through his nostrils to regain some control and thought of what she said before she faded, “He’s here:”

*Fuck.*

Max grabbed the tracking device, a round computer chip, from the sink, dropped it on the floor, and crushed it under his boot. He left the bathroom and went to wake up Molly. It was time to go.

Justin pulled the Impala over onto the shoulder about thirty meters short of The Whispering Pines Motel. From where he was parked he had clear view of a bullet ridden Riviera. The red tracking light blinked away three miles ago. There was only one possibility, the agent removed the device, but the Riviera must be his. The thing was full of bullet holes. The windows were gone. Unless he’d driven through some phantom transporter and ended up somewhere in Afghanistan, the Riviera had to belong to the agent. When a black van drove by, slowed, and turned into the drive of the motel it confirmed his suspicion.

Adil Faheem poured gasoline over all the debris left in the wake of the code blue protocol: piles of broken computers and television screens. He lit a match, watched the fire build, and then left the Morning Star compound and drove to the nearest Denny’s. He was starving.

As Molly rested she dreamed. Her dreams were episodic, fragmented, and malicious. Disturbing images popped up from a life she didn’t know, voices she’d never heard, piped in from an outside source:

*How is she?*
*She’s doing very well.*
*Continue on with phase two.*
*Yes mam.*

Jump cut to giant figures in white hovering over her with surgical masks and hospital caps:

*Reflexes?*
*Above average and steadily improving.*
*Phase three.*

In the distance someone called her name. In the next frame her dad held her in his humongous arms. He was wearing a military coat with medals. She reached out with her tiny hand and
touched his chin, and he handed her over to someone in a white coat. Molly turned and saw her mom lying in a hospital bed. Her eyes were closed. She wasn’t moving. She wasn’t breathing:

She’s beautiful, sir.
Take her.

And from a thousand miles away:

Molly, wake up!

And from a loud speaker:

Initiate!

Nelson didn’t mind working the desk overnights at Whispering Pines. He had plenty of stuff to help pass the time: comic books, internet porn, an overabundance of dank weed—and a tank of nitrous his buddies stole from a dentist’s office a couple days ago. Nelson smoked the weed until he was stupid and then about every nine minutes or so he’d suck on the nitrous and jerk off to the porn. His favorite site was Milfs in Uniform, scores of sexy big titted ladies posing as librarians, nurses, and schoolgirls. It chafed the hell out of his dick, but it made the night go faster, and nobody came to Whispering Pines in the middle of the night anyway. He was usually alone for the entire shift. Sometimes in the morning, when the sun was up, a guest would inquire about the plumbing or ask for directions, but for the most part he was alone from 11:00 P.M. to 7:00 A.M., which is why he nearly injured himself zipping his pants up dudes in blue mechanic shirts came through the door seemingly from nowhere:

Holy shit, you guys scared me!

The first guy in the door, a long haired blonde dude with a thick neck and mirrored sunglasses, grabbed Nelson’s laptop and looked at the spread ass of a superhot porn star posing as a cheerleader—one of Nelson’s favorite’s. He tipped his sunglasses at looked at Nelson disappointedly:

What? Come on, this job is fucking boring.
I hardly ever see anybody...ever.

The second guy through the door had a shaved head with the phrase “Your God is dead” tattooed from his left ear, around the back of his head, all the way to his right ear, and he grabbed the registration book and flipped through it:

Dude, don’t, you’re not...c’mon!

Thick neck folded Nelson’s laptop the wrong way snapping it in two:
Are you kidding, what the fuck, seriously?!

Skin head dude stuck a gun in Nelson’s face:

Wait, what...?

Molly wouldn’t wake up. Max shook her, shouting her name, telling her to wake up and that it was time to do, but she wasn’t responding. He was practically on top of her when the door burst open and a man in a blue uniform entered with a shot gun. Max flew over the bed taking Molly to the floor with him. The man with the shot gun had a shaved head with some words tattooed around the back. He pumped and fired the gun randomly around the room, exploding the television, a bedside lamp, and a large mirror. Max popped up from the side of the bed and fired three shots into the skinhead’s chest, sending him flying back out the door. A larger man with a blonde ponytail and a massive neck replaced the skinhead in the doorway armed with a Springfield semi-automatic .45 in each hand. Max ducked behind the bed, expecting a barrage bullets to rain down around him, but he only heard one shot, and then nothing. He looked up from floor. The blonde guy was facedown, bleeding on the carpet. Max touched Molly’s face. Her eyes were squeezed shut and she was mumbling something. Then he heard a familiar voice:

Hi Max.

Justin stepped over the body as he entered into the room.

The Russians poured ice water over Max to keep him awake. He’d been deprived of sleep for at least seventy two hours. Sleep deprivation was a classic method of interrogation left over the Russian Soviet days. Max opened his eyes, looked at the room, and closed them again. A stinging slap to the face brought him to attention:

Okay, okay, I’m awake!

Max was strapped to a chair with American automatic handcuffs—rigid strips of plastic that cut deep into his wrists and ankles. He was in the center of a windowless room, maybe a bunker or a cave since the walls were dirt. Bare light bulbs were strung up around the room. The ugly yellow glow from the bulbs offered little in the way of illumination, making it difficult for Max to distinguish the blurry figures that stood around him in the room. There were five of them. Two of them, armed, stood at the entrance. One stood in front and slapped his face again. One stood behind him and yanked his head back by pulling his hair. Another stood off in the corner. Max couldn’t see his face, but he could see that he was decorated—an officer. Each toe on his right foot had been crushed individually with a claw hammer. Max had learned that the most painful injury a person can suffer is a broken femur. Crushed toes must run a close second. The cigarette burns on the side of neck sometimes pulled his attention from his foot, and his nose, broken with a rubber truncheon, kept his eyes watering constantly.
It’d been at least three days and the Russians still hadn’t asked him a question leading Max to believe that this was no interrogation that the sole purpose was to drive him mad with torture and then likely end it with a bullet through his head. The Russians understood that torture was an ineffective method of obtaining answers, that a prisoner under enough physical and emotional duress would give you any information you were looking for whether it was true or not. Max wasn’t being interrogated he was being tortured out of principle. He was the enemy and he would be a lesson to the Chechen army as to the ruthlessness of the Russian force. As if the rape and slaughter of women and children weren’t enough of a statement.

With a crack, a stick was brought down on the fingers of Max’s right hand and he howled from the unexpected shock. The blurry figure in the corner spoke in English:

*And the finger prints.*

Apparently they knew Max was American. The man in front of Max, a soldier, grabbed a blowtorch and lit it while the man behind struck him in the head with a truncheon nearly knocking him unconscious. Max struggled to stay awake to avoid be awakened with more ice water. He was already soaked and frozen clear through. The soldier with the torch grabbed the index finger from Max’s right hand and applied the flame to the end of it. Max clenched his teeth and growled against the pain. His eyes rolled up into his head when an explosion in the doorway slammed the two armed guards to the floor. Alarmed shouts of Russian filled the room and then gunshots. The soldier with the torch fell dead. The torch remained lit. Max felt the barrel of a gun pressed to the side of his head, but with another gunshot the barrel fell away as the soldier behind him slumped to the floor.

Justin emerged through the smoke and debris:

*How you doin Max?*
*Your left.*

Justin swung left. The decorated blur stepped out of the corner with a handgun leveled on Max. Justin yelled in Russian:

*Broctye!*

The Russian officer pulled the hammer back. Justin tried English:

*Put it down!*

The officer looked at Justin, grinned, and spoke in broken English:

*We’re all dead here, you know. You’re dead, he’s dead...I’m dead.*
And then he put the gun to the side of his head and pulled the trigger. Dark red sprinkled the dirt wall as his body dropped to the floor. Justin went to release Max. He cut the handcuffs with a knife from his belt. Max looked up at him:

*Not a moment too soon.*
*Let’s go.*
*My foot is out.*
*I gotcha.*

Justin supported Max and they hobbled out of the room.

Max sat on the end of the motel bed. Molly was still out and dreaming. Justin surveyed the room:

*This place is filthy.*
*What are doing here?*
*What do you think?*
*The tracking device.*
*Bingo.*
*Figures they’d send you.*
*I’m their star player. How long has she been out?*
*Couple hours. Why?*

Justin lit a cigarette and offered it to Max:

*We have to go before she wakes up.*

Max accepted the cigarette:

*No way, she comes with me.*
*That’s not possible.*
*I’m not leaving her. What’s going here? Who are these fuckers?*

Justin lit himself a cigarette and dipped outside. Max checked on Molly, tried to wake her again:

*Come on Molly, wake up. Shit.*

He checked his guns to make sure they were fully loaded. Justin came back in:

*There’ll be more on the way.*
*What the fuck is going on?*

Justin pulled a business card from his jacket pocket and handed it over to Max:
I found this on one of them.

Max looked at the card. There was only a phone number. Max knew the number well. He had it programmed into his cellphone:

Surprised?
Not really. So, what’s with the girl?

Justin presented the lipstick USB drive and tossed it to Max:

It’s all on here. We should go!

Molly woke up and jumped on Max’s back. She wrapped her legs around his chest and cuffed his ears hard. A loud ringing, like a gong shattered his thinking and he whirled around and threw Molly onto the bed. She bounced off the bed and onto her feet. Justin flipped his bed out the door. Max backed up barely dodged Molly’s foot as she leapt into the air and swiped at his face. She pursued him throwing skilled kicks and punches. Max did his best to block her, refraining from returning any of the blows. Justin stepped up with a gun:

No!

Max pushed the gun away. Molly kicked Max in the crotch and he dropped to his knees. Justin tucked his gun away. When Molly came at him he punched her in the face—one punch—and she flew back onto the bed. She was unconscious and her nose was bleeding. Justin helped Max to his feet:

Talk to me.

Justin lit himself another cigarette and watched as Max checked Molly’s condition. Max wiped the blood from her face with his sleeve. Justin stood over the bed. He told Max everything he knew about the project, everything he saw on the lipstick USB—how M2 was devised as an answer to the Machine Project blunder. Children, newborns, were altered, enhanced, improved, programmed to track and remove the nine original machines, the nine mistakes. Molly was one of them. Max backed away from her. Justin looked out the door:

We should really go.
I’m not leaving her.

Max could hear Annie from the bathroom, “Save her.” He planned to do that. Justin held his patience and then produced a small plastic syringe. Max almost choked:

What is that?
I found it in your bathroom. Smell it.
He handed the needle over. Max didn’t need to pull the plunger to smell the cyanide, the aroma of almond was overwhelming:

*Who did this?*
*I don’t know. I could make an educated guess.*

Max didn’t have to guess. He went cold. He suddenly understood that there was nothing he could do and he felt the blood drain away from his face. He was being punished for having split loyalties, for caring about more than the mission. He felt guilty for not having smelled the poison when he found Annie bluing in the tub. His senses had been blocked by grief at the time, but of course, Annie’s death wasn’t an accident. It was true the Annie liked to use needles recreationally, she knew how to control the dosage. The likelihood of her overdosing was next to nil. It didn’t make sense. She’d been removed, taken out of the equation, in an effort to redirect Max’s priorities. He suddenly felt like puking. Justin handed him a set of keys. Max regained some composure:

*What’s this?*
*Keys to the Impala. Get out of here. I’ll take care of the girl.*
*I can’t do that.*
*Max! Listen to me, I’m only going to make this offer once. It is my sole mission to hunt you down and kill you. I am offering you a head start, because I sympathize. I am sorry for your loss. Take advantage of this offer and go find out who killed your fiancé. This offer never leaves this room.*

Max stood, dumfounded, and light headed.

Justin waited for Max to say something. They were running out of time. Max went to the girl. She was starting to come around:

*I promised her.*
*I’ll take care of her.*
*Swear it. Swear to me that you’ll protect her.*
*I swear.*

Max nodded and grabbed the keys. He knew that Justin would keep his word, that he’d protect Molly. He stopped to look her before heading out the door. Justin stopped him:

*48 hours.*
*Right.*

Justin watched Max walk out of the room, through the parking lot, and out on the road where the Impala was parked. Max started the engine, turned on the headlights, made a U-turn, and headed south. Justin grabbed his gun and went to wake Molly up.
Three and a Half Months Later

Doctor Heinrich Schulze checked the temperature, 39 degrees Celsius and rising. He hated the heat. The window air conditioner in his office constantly groaned and could barely keep interior climate manageable. He had a private practice on the outskirts of Mexico City and as much as he detested the climate he’d been banned from practicing medicine in almost every other country on the planet for performing questionable procedures on patients with terminal diseases. Dr. Schulze’s practice was so private that unless you knew somebody who knew somebody—who in turn had friends in low places—you wouldn’t even know of its existence. Dr. Schulze’s practice was so private that unless you knew somebody who knew somebody—who in turn had friends in low places—you wouldn’t even know of its existence. He had a private practice on the outskirts of Mexico City and as much as he detested the climate he’d been banned from practicing medicine in almost every other country on the planet for performing questionable procedures on patients with terminal diseases. Dr. Schulze’s practice was so private that unless you knew somebody who knew somebody—who in turn had friends in low places—you wouldn’t even know of its existence. He was the go to for people who had nowhere else to go. Crime lords looking for a new faces, politicians looking to terminate their girlfriend’s accidental pregnancies, wealthy corporate sharks in need of quick organ transplants with no questions asked all came to Doctor Schulze’s practice. For the right money there was no procedure Doctor Schulze wouldn’t perform. He was wiping the sweat from his forehead with the sleeve of his shirt when someone knocked on his office door. He wasn’t expecting anyone. He had no appointments to keep. Another knock. He went behind his desk and pulled open a drawer that held only a gun. He didn’t take the gun out, but he left the drawer opened—and settled into his chair:

It’s open.

The door swung open and there stood a man in a black suit with a black Mohawk. Doctor Schulze didn’t recognize the man:

Can I help you?
Dr. Heinrich Schulze?
Yes, that’s me.

Machine walked into the Doctor’s office. He left his sunglasses on. Doctor Schulze rested his hand on the gun:

Do I know you?
No.

Doctor Schulze didn’t appreciate the brevity in the man’s answers:

Then...?
I was referred to you by a mutual friend.
A mutual friend? I find that very unlikely.
Why?
I have no friends.
Ah.

The doctor was sweating around the collar. His armpits were slippery. He wanted to blot them with his shirt, but he was afraid to move:
Would you mind telling me—?

Machine reached into his jacket and Doctor Schulze wrapped his fingers around the grip of the gun. Machine pulled out a manila envelope and tossed it on the doctor’s desk:

*What’s this?*
*Ten thousand dollars.*
*Really.*
*I need you to remove something.*
Six Weeks Later

Director Botvinnik sat at a sidewalk table outside Bar Louie’s with a bottle of vodka and an ashray overflowing with cigarette butts. He looked at his watch. The time was 3:17 in the afternoon. Milwaukee seemed unusually quiet for this time of day. Water Street was generally a busy part of town, bustling with tourists, shoppers, and artists, but today it was virtually uninhabited thanks to the heat: 33 degrees Celsius in the shade. Director Botvinnik was little affected by heat. He found it cleansing, and with a steady diet of vodka his pores sealed up nicely, so sweating wasn’t an issue. He decided he liked Milwaukee, that it was a good city for dying. Just over two decades ago it was home to one of the most notorious serial killers in history who killed and raped and ate 17 men and boys. Today it would be the location of Director Botvinnik’s suicide. He would drink this bottle of vodka, buy another, and return to his hotel room where he would proceed to paint the walls with his brain. It made didn’t make much sense even to him. The connection was vague at best, but that didn’t bother him. It was time to step down. It was the honorable thing to do after the disastrous Machine Program, and so like an old dog wandering into the woods alone, Director Botvinnik came to Milwaukee to die. He poured another glass of vodka and lit a cigarette when he noticed he had a visitor.

Standing across the table from him was a man dressed all in black: a black, long sleeved t-shirt with the blood red words ‘God Killer’ splattered across the chest, black jeans, and black Doc Martens on his feet. The man’s face was pale, his head was shaved, and he wore black wraparound sunglasses. There was something familiar about the man that Director Botvinnik couldn’t put a face on, the way he held himself. The way he stood motionless without saying anything. The man tossed a computer microchip onto the table that the Director identified immediately. It was a camera, a recorder, designed to be attached directly to the optic nerve of the eye. Any and all electrical impulses that the optic nerve sends to the brain is recorded and sent directly to Morning Star. The camera, called the optic trace, is a Morning Star exclusive, and it was used only once:

Justin Brodsky...subject zero.

Machine removed the sunglasses. A fresh lightning bolt scar ran from his left eye socket all the way back to his ear. A second scar ran straight up over his eyebrow, and a third scar ran down his cheek bone. The left eye was gone, replaced by glass—not a glass eye, but a chunk of black glass. It occurred to Director Botvinnik that removing the camera had been a harrowing experience:

Won’t you sit down?

Machine sat in the chair directly across from him. The director filled the glass with vodka and offered it:

The best vodka Milwaukee has to offer.
I’m good.
Of course.

Botvinnik downed the glass in one swallow and then refilled it:

Well, you found me.
I did.
If you’re here for revenge or retribution—
I’m not.
Then what—
We need to talk.

Director Botvinnik studied Machine’s face. With his shaved head, his pale skin, the extreme scarring, and chunk of glass where there should’ve been an eye—he was looking lie a machine more than ever:

Okay. Let’s talk.

TO BE CONTINUED.

EPISODE TWO: The New Machine COMING SOON!