Research & Grants Expo

2021

Session 11:30-12:00

Researcher(s)
Supply Chain Risk Management – **Kihyun Park** – SBUS
Computational Modeling of Traumatic Brain Injury – **Rika Carlsen, Sushan Nakarmi, Yaohui Wang** – SEMS
Searching for Jefferson's Salamander: eDNA survey – **Catie Hanna, Melissa Hillwig, Rachel Gress** (Student) – SEMS
"RMU – We Care" – Opioid Prevention in Higher Education – **Terri Devereaux** – SNEHS, **Maureen Keefer** – Student Life, **Holly Harmon**– Counseling Center, **Jeffrey Schmetzer** – Public Safety Office, **Tim Jones** – RMU Media Center, **Chelsea Blakely** – Athletics, **Zachary Hadfield** (Student) – SNEHS
Treatment optimization in a model of drug – **Gavin Buxton, Paul Badger, Melissa Hillwig** – SEMS

Supply Chain Risk Management and Lean Practices: A Contingency Approach

Kihyun Park

Introduction

This study uses cluster analysis to identify four clusters based on the levels of risk management and lean practices (high to low) and investigate their impact on performance.

Table #1

Construct	# of Items
Lean Practices	3
Supply Chain Risk Management	3
Financial Performance	5

Methods

A two-step clustering procedure was used.

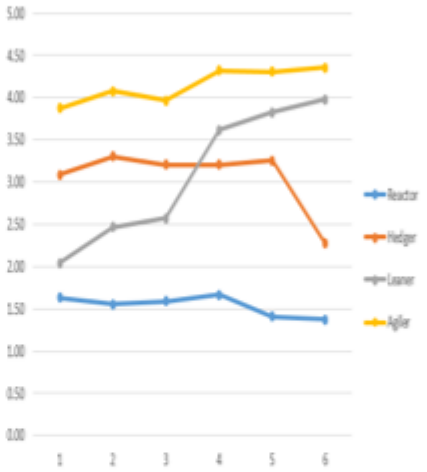
A hierarchical method determines the number of clusters.

After determining the number of clusters, K-means cluster analysis was performed to classify 198 companies to four groups.

Table #2

	Reactor	Hedger	Leaner	Agiler
RM1	1.63	**3.08**	2.04	3.88
RM2	1.56	**3.31**	2.47	4.08
RM3	1.59	**3.20**	2.57	3.97
LEAN1	1.67	3.20	**3.62**	4.32
LEAN2	1.41	3.25	**3.83**	4.31
LEAN3	1.37	2.27	**3.98**	4.35

Figure #1



Results

The more a firm adopts and implements lean practices and supply chain risk management, the higher level of financial performance that a firm will achieve.

Conclusions

The analysis concludes that firms achieve the highest financial performance if they implement both lean practices and supply chain risk management at a higher level than others do.

This study provides a focal company with guidelines for making the supply chain process more secure and profitable.

Bibliography

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Computational Modeling of Traumatic Brain Injury

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School of Engineering, Mathematics and Science (SEMS)
Robert Morris University

Introduction

To reduce the risk of blunt and blast-induced traumatic brain injury, we must first fully understand how mechanical loads to the head at the macroscale translate to the damage of neurons at the cellular level. The complex loading conditions in blunt impact and blast events make it challenging to understand which characteristics of these loading events cause the most injury and lead to the greatest risk of long-term impairment. Through the use of biofidelic finite element head models, we can begin to elucidate the relationship between head loading conditions and neural damage, allowing us to identify the most injurious impact and blast loading conditions and develop new targeted approaches to reduce the risk of injury.

Predicting Severity of Injury

Head Impact 1

Head Impact 2

Measured Head Acceleration | **Finite Element Analysis** | **Strain Injury Map** (Red = Damage)

Head Kinematics & Injury

Bliven et al., 2019

Helmet Testing Standards

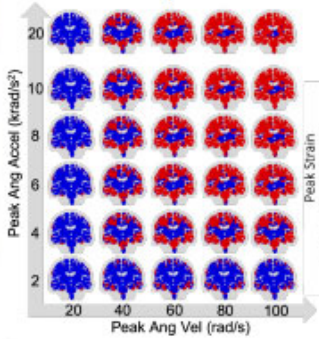
- Traditionally, helmets are designed to limit **linear acceleration** of the head
- More recently, standards are being updated to include a measure of **rotational head motion**
- **Objective of Study:** Determine whether angular acceleration or angular velocity should be limited to reduce risk of injury

Method: Conducted a parametric finite element analysis

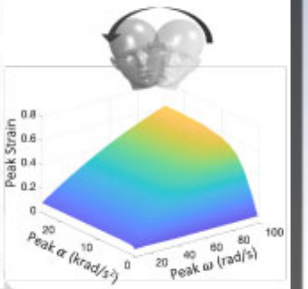
- Varied Angular Acceleration of Head: $\alpha = 0.5 - 25$ krad/s^2
- Varied Angular Velocity of Head: $\omega = 10 - 100$ rad/s

Result: Both angular acceleration and angular velocity have a significant effect on the peak tissue strains and strain rates that develop in the brain, reinforcing the importance of accounting for both these kinematic measures when evaluating injury risk

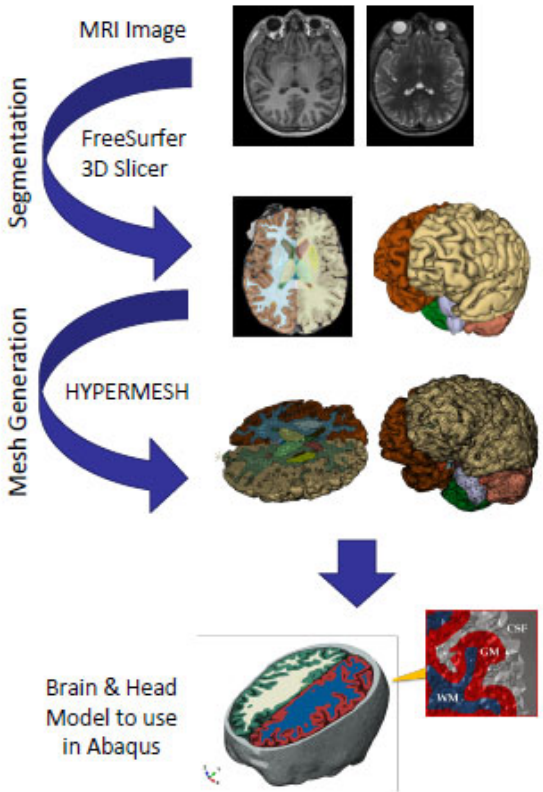
Maximum Principal Strain > 15%



Coronal Rotation Results



3D Finite Element Head Model



Acknowledgement

We gratefully acknowledge the Panther program and support from the Office of Naval Research (Dr. Timothy Bentley) under grant N00014-21-1-2044.

Searching for Salamanders: eDNA survey for *A. jeffersonianum*

Rachel Gress, Missie Hillwig, Catie Hanna

Robert Morris University

Ambystoma Jeffersonianum

- Long lived (10+ years)
- Fossorial adults (lives underground)
- Migrates to breed in natal pond in late winter/early spring
- Ponds that are suitable for *A. jeffersonianum* are typically
  - Shallow (depth: <1m)
  - Fish-free
  - Upland
  - pH > 6+
- Egg masses surveys are the most common way of finding populations, but easily missed
- Hybridize with other *Ambystoma* species, often forming unisexual, polyploid individuals

  A. laterale *A. barbouri*
  A. texanum *A. tigrinum*

Conservation

- Populations threatened by habitat destruction
  - Draining natal pools
  - Deforestation
  - Acidification
- Genetic erosion due to hybridization

Jefferson's salamander is listed as a "vulnerable" population in PA, but environmental degradation and poor monitoring suggest that the population may be more imperiled.

Project Goals

1) Test the viability of using eDNA to survey for *A. jeffersonianum*
2) Use eDNA to survey ponds for *A. jeffersonsinum* presence
3) Look for evidence of unisexual hybrids and other Ambystomid species

Egg mass identified in visual survey (Left) Adult Jefferson's salamander (Right)

Methods

1) Water sampling (see chart below)
Two 500 ml samples collected in sterile bottles from each pool at each sampling period

- Repeated periodic sampling of ponds Bell Acres ponds allows us to determine how long eDNA is present and when it is viable to sample.

	Pond	Observed Ambystomids	Pre-Migration	New eggs	Post Egg-laying	Late Spring (larvae)	mid-Summer
1	Bell Acres Big	*A. jeffersonianum*, *A. maculatum*	X	X	X	X	X
2	Bell Acres Little	*A. jeffersonianum*	X	X	X	X	X
3	Sewickley Heights	*A. jeffersonianum*			X		
4	Gas well	*A. jeffersonianum*			X		
5	G.C.	*A. jeffersonianum*			X		
6	Grouse Run	*A. jeffersonianum*			X		
7	Downing Drive 1	*A. jeffersonianum*, *A. maculatum*			X		
8	Backbone road	None			X		
9	H. C.	None			X		
10	Downing Drive 2	None			X		
11	Downing Drive 3	None			X		
12	Wood frog	None			X		
13	HOLT 2	None			X		
14	Nike	None			X		

Green ponds have well documented activity, whereas Blue ponds are those where Ambystomids have been documented only once or twice.

Methods (cont.)

2) Filtration
Collects concentrated organic material (followed Laramie et al 2015)

3) DNA extraction
Concentrates cells from filter membranes and releases and concentrates eDNA into pellet

4) Identification and testing of primers

- Primers act as biological search criteria; they look for DNA present in the target species
- More related species will have more common DNA; some DNA is unique to a species or group of species.
- We will use primers to find DNA unique:
  - *Ambystoma* (selects for any in genus)
  - unisexual *Ambystoma* (selects for hybrids)
  - bisexual *A. jeffersonianum* or *A. laterale* (selects for non-hybrid)
  - *Ambystoma jeffersonianum*
  - *Ambystoma maculatum*
- Primers will be tested using tissue from known species.
- eDNA prepared for PCR
  - primers, probes, polymerases, buffers

5) PCR
Replicates the DNA "found" by the primers so that it can be visualized in a gel

6) Gel electrophoresis
Allows for visualization of replicated DNA

Implications

- Successful implementation of eDNA surveys will improve identification and management of critical salamander habitat.
  - If eDNA is present pre-migration, then water samples taken at any time of the year should confirm presence of Ambystomids.
  - qPCR may be used in future studies to correlate to egg mass density and time lapsed
- Presence of hybrids would lead to further research on how hybrids affect *A. jeffersonianum* population dynamics and reproductive behaviors

References

- Laramie et al 2015. USGS techniques and methods, 2-A13.
- NatureServe Explorer
- AmbibiaWeb.org
- Noel et al. 2008. Copeia 1: 158-161
- Doyle et al 2011. Molecular Ecology Resources 11: 101-106.

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Presented at the 2021 R&G Expo @RMU

Financial support from the RMU Faculty Enrichment Fund

"RMU We Care"
Opioid Prevention in Higher Education

Terri Devereaux, PhD, FNP-BC, Timothy Jones, PhD, Tiffany Guthrie, MS, LPC, NCC, Maureen Keefer, M.Ed,
Chief Jeff James, Chelsea Blakely, Zachary Hadfield

Introduction

- Approximately 3 million people in the United States and 16 million globally have an opioid use disorder (OUD)
- Pennsylvania had the third-highest number of opioid deaths in the country in 2014, with Western Pennsylvania having six of the counties with the highest drug-related death rates
- Opioids are the drugs of greatest concern among the college student population as students who use opioids are more likely to combine them with other nonmedical drugs, depressants, or alcohol
- RMU recognizes the importance of supporting all university students, athletes, parents, faculty/staff, coaches in the prevention, detection, and intervention for OUD
- A joint taskforce of representatives from the Office of Student Life, Counseling Center, Departments of Nursing, Athletics, RMU Police, and Media Center have identified several opportunities to build on existing programs, to coordinate services, and to improve awareness of resources

Goals

1. Provide 24/7 access to education, detection, and intervention resources
2. Develop strategies for early detection and intervention
3. Provide support to students who have the experience of living with or have lost a loved one to OUD
4. Provide on campus disposal dropbox for opioids

*Grant extended due to covid-19 pandemic

Strategies

1. Provide 24/7 access to resources
   - Incorporate resources into new Counseling Center webpage that includes a reporting mechanism for students/faculty/staff/athletes/coaches to provide 24/7 ready access to education, tools, and resources that target a wide audience of students, athletes, parents, faculty/staff, and coaches
   - Embed reporting software into current student app
2. Develop strategies for early detection and intervention
   - 3 videos to enhance education for early detection, reporting, and to hear the story of a RMU parent/student who have lost a loved one to OUD
   - Public Service Announcements for RMU radio segments and streaming on video screens throughout campus including sporting events
3. Provide support to students who have the experience of living with or have lost a loved one to OUD
   - Implement support group for those who are living with or experienced the loss of a friend/loved one with addiction
4. Provide on campus a disposal dropbox for opioids monitored and managed by RMU police

Presented at the 2021 R&G Expo @RMU

Treatment Optimization in Cancer Model

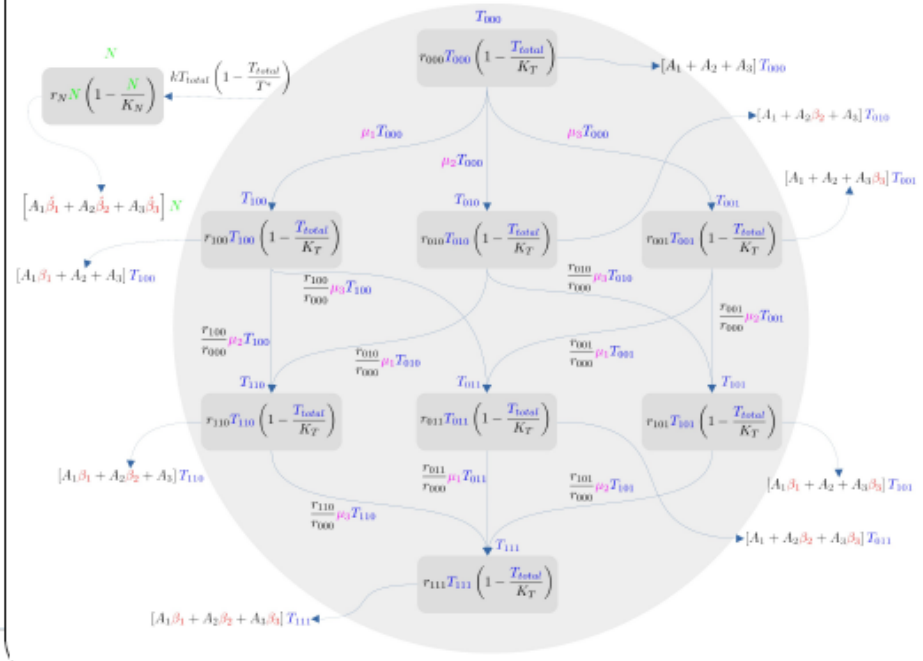
Gavin A. Buxton, Paul Badger, Melissa Hillwig

Science Department. Robert Morris University

Introduction

We expand on computer models of tumor and normal cell interactions during chemotherapy to include the effects of multiple drugs. Through a series of simulations, we attempt to optimize the choice of drug and the treatment protocol. In particular, through the use of computer simulation we can determine the optimum concentration of chemotherapeutic drugs and administration times that will eradicate a tumor, while minimizing the probability of resistant strains emerging and also minimizing the destruction of normal cells.

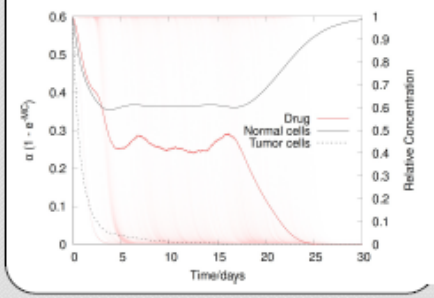
Methods

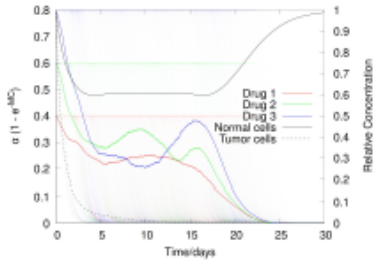


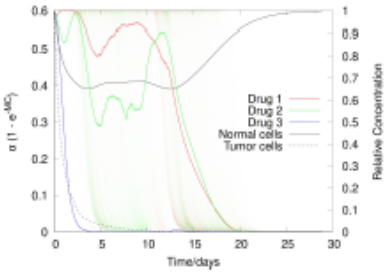
Conclusions

Using a simple mathematical model of tumor growth, acquired or induced resistance, and normal cell concentrations we optimize the administration of chemotherapeutic drugs to minimize both the reduction in normal cell concentrations and the probability of highly-resistant strains of tumor cells emerging. Such a simple model allows us to simulate millions of different treatments to predict the optimum treatment protocol. Patient-specific care is a goal of chemotherapy, and it is expected that computer simulations that can predict in real time the optimum course in treatment as a consequence of initial and on-going patient evaluations will play a large role in future chemotherapeutic treatments.

The optimized treatment for a single drug, and the normal and tumor cell concentrations.







The time and dosage of three different drugs is optimized for when each drug has differing effects on tumor and normal cells (in the two figure). It is predicted that more detrimental drugs should be administered sooner and less frequently, and that an intermediate cytotoxic drug be offered more at the beginning and end of treatment, with the less harmful drug being administered throughout treatment.