



How To Make An Effective Poster



Undergraduate
Research
Center

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With information kindly provided by Lolita Adkins and Jeremy Foin



“The more strikingly visual your presentation is, the more people will remember it. And more importantly, they will remember you.”

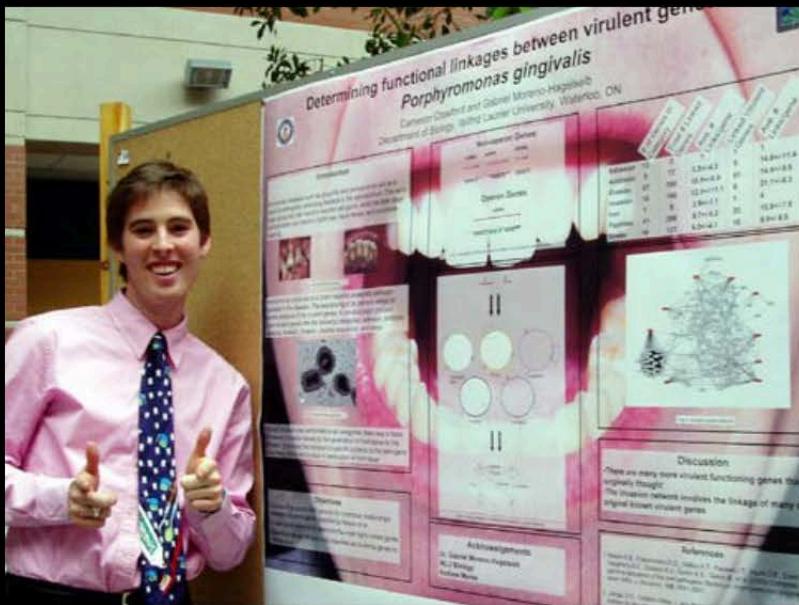
— Paul Arden

What is the purpose of an academic poster?

“...to display information in a clear, concise manner, while generating interest to engage in a discussion”

“...a big piece of paper (or wall-mounted monitor) that can communicate your research at a conference, and is composed of a short title, an introduction to your burning question, an overview of your novel approach, your amazing results in graphical form, some insightful discussion of aforementioned results, a listing of previously published articles that are important to your research, and some brief acknowledgement of the tremendous assistance and financial support conned from others” (Purrington 2014)

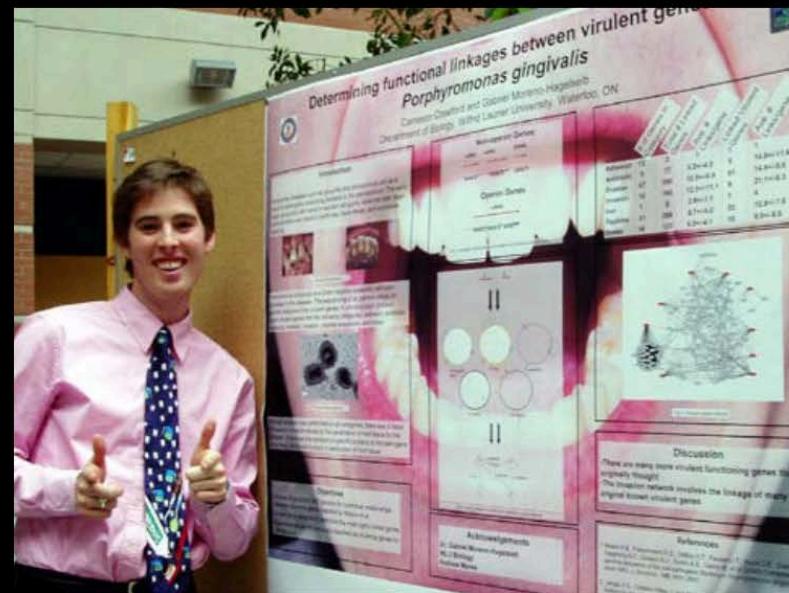
NO



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YES



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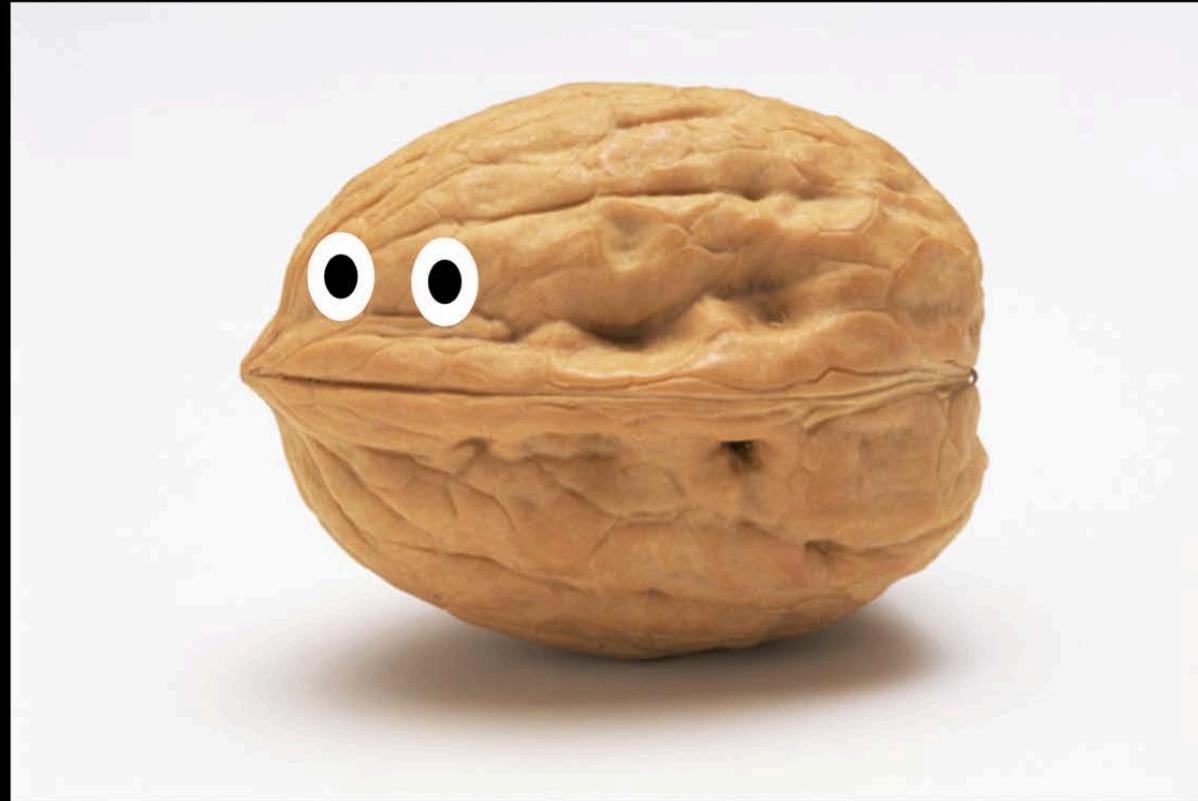


The implications, please...

HERETICAL STATEMENT #1:
conference presentations don't really
have that much to do with the research.

HERETICAL STATEMENT #2:
in reality, conference presentations are
pretty much all about networking and
shameless self-promotion.

IN A NUTSHELL:



**YOUR POSTER MUST
GRAB EYEBALLS.**

Poster Presentations Guidelines: The Must Haves



A New Rodent Model of Pediatric Sports-Related Concussion

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Introduction

Over 50% of traumatic brain injury (TBI) occurs in individuals less than 24 years old. The majority of these injuries are mild and most patients fully recover. To study the effects of sports-related injury, we attached a metal disk directly to the skull and rotated it at different velocities to induce a rotational concussive (RC) injury. The metal disk acts as a helmet to diffuse the force across the head. To test this model in the p30 rat, we generated a range of injury severities by varying the velocity of the rotating disk. In the poster velocity from 2 to 6 m/s to generate increasing force. In addition we addressed the consequence of having a mild injury followed by a moderate injury on the subsequent performance following the initial insult.

Behavioral outcome measures included: cognitive function, motor function, and memory.

Methods

Experimental Design:

- 40 rats (p30 Sprague-Dawley rats) were utilized.
- Prior to injury, animals were pre-trained on the Rotarod until they could run for 60 seconds without falling off.
- Animals received either a sham, single, or moderate injury followed by a second injury 24 hours later (moderate, mild-moderate, or mild).
- Animals were tested on the Rotarod on days 1 and 4 post-injury.
- Spatial learning was assessed on the MWM on post-injury day 4.
- Rats were anesthetized & perfused with paraformaldehyde on post-injury day 8.

Pediatric Sports-Related Concussion:

- Injury was induced using a 2% isoflurane (inse cone) in 2:1 N₂O:N₂ for 10 minutes.
- Marlene was reacted under the skin on top of the head as a marker.
- A mid-line scalp incision was made and a metal disk was glued to the skull midway between Lambda and Sagittal suture.
- The metal disk was rotated at different velocities and the angle of pitch was varied to create a range of injury severities.
- Injury was induced using the CCI device if TBI (Velocity = 2 m/s). Injury was fixed for 5 min and ended at 100 m/s. Velocity was varied to create a range of injury severities.
- Animals received either a sham, mild (2 m/s) or moderate (5 m/s) injury.

Dose:

- Tissue was sectioned at 40 µm on a rotary microtome.
- Untreated (M0/0) immunohistochemistry was utilized to label neurons.
- Every 5th section was analyzed before Bregma -0.3 and -0.4 mm.
- The number of neurons in the hilus, CA3, and pretectal cortex was quantified similarly using StereoInvestigator (Figure 1C).
- It is critical to develop and optimize models of sports-related injury as this is the largest and fastest growing population of mild TBI in the United States.

Summary & Conclusions

• Animals with a 2 m/s injury (mild) had neither a motor nor spatial learning deficit.

• Animals with a 5 m/s injury (moderate) also displayed no motor deficit. However, latency to find the hidden platform was significantly increased compared to sham animals.

• Repeat injury animals displayed no deficits and performed similarly to sham animals in the water maze.

• Initial stereological counts suggest no hippocampal CA3 damage. Additional counts are needed to assess the hilus and parietal cortices.

• It is critical to develop and optimize models of sports-related injury as this is the largest and fastest growing population of mild TBI in the United States.

Hypothesis

We hypothesized that our injury model would result in cognitive deficits in the absence of motor deficits or gross neuronal degeneration as seen in humans who have sustained a sports-related concussion.

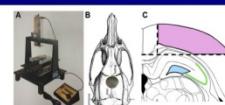


Figure 1: Schematics of the CCI device (A), injury cap placement (B) and regions of interest (cortex = pink, hilus = blue and CA3 = green) for stereology (C).

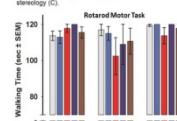


Figure 2: There was no difference in motor performance on the Rotarod

Hypothesis

We hypothesized that our injury model would result in cognitive deficits in the absence of motor deficits or gross neuronal degeneration as seen in humans who have sustained a sports-related concussion.



Figure 3: Animals receiving a moderate injury (5 m/s) performed significantly worse than shams. *p < 0.05



Figure 4: Neither a mild nor moderate injury (5 m/s) caused a deficit in water maze performance.

Summary & Conclusions

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• It is critical to develop and optimize models of sports-related injury as this is the largest and fastest growing population of mild TBI in the United States.



Figure 5: Stereology analysis of the cortex (A), CA3 (B) and hilus (C).

Acknowledgements



Does Perinatal Exposure to DDTs and the Development of Glucose Intolerance Promote Skeletal Muscle Deficiency?



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Abstract

The once ubiquitously used pesticide DDT and its environmental DDE (together DDTs) have been an environmental concern for nearly 40 years. Recent epidemiological and mechanistic data link DDT exposures with devastating diseases such as obesity, diabetes, and skeletal muscle deficiency. Our work surrounds perinatal exposure of DDTs and adult phenotyping. C57BL/6J mice were exposed to DDTs during gestation and postnatally fed a diet based on normal chow, and switched to high fat diet (HFD) at 4 months to initiate obesity. Three months after exposure, dams were found to be glucose intolerant, while their female offspring displayed elevated fasting insulin. Disruptions in peripheral glucose homeostasis were observed in the offspring that rely heavily on glucose uptake were displaying a phenotypic defect. One month after being put on HFD (5 months old) dams were found to be glucose intolerant. To assess muscle deficiency, we tested forelimb grip strength (GS) using Chatillon Machinery Grip Strength meter. GS was measured at 5 min intervals with 15 trials/day. On days two and three, overall grip strength, mean strength, first and last third of each trial, and standard deviation (SD) of grip strength in each trial were calculated. There was significant change between treatment groups in days two and three, however F1 offspring had no significant change between treatment groups. This suggests that DDTs impair skeletal muscle function, further research is needed to examine potential indirect effects that DDTs have on skeletal muscle.

Methods

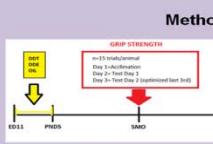


Figure 1a: Experimental Design Diagram

Results

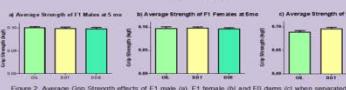


Figure 1b: Average Grip Strength effects of F1 male (a), F1 female (b) and Dam (c) separated by Day

Results continued

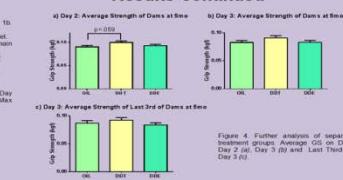


Figure 1c: Further analysis of separate treatment groups. Average GS on Day 2 (a), Day 3 (b) and Day 4 (c)

Conclusion

- At 5 mos, DDTs did not effect GS regardless of sex, exposure type, or GS criteria (Avg, SD, SE, CV).
- Dam GS on Day 3 (Fig 3b) decreased compared to Day 2. Given smaller SE and CV (data not shown) we conclude that there is a decrease in the strength of Dam Day 3.
- Optimizing the Last Third on Day 2 is the best strategy to collect grip strength.

Acknowledgements

Extreme gratitude to Michele La Merrill Ph.D. for giving me this opportunity to work in her lab. She encouraged me to build novel skills as well as step up my extracurriculars. Melinda Scholten Program and California Alliance for Minority Research (CAMP) Program for providing me the resources for my future career in research.



Introduction

DDTs are part of a group of toxicants named Persistent Organic Pollutants (POPs) that accumulate in animal tissues. DDTs are a risk factor for glucose intolerance, which is linked to impaired glucose uptake in tissues. There is no prior evidence suggesting DDTs directly effecting grip strength in skeletal muscle.

Hypothesis

Perinatal exposure to DDTs causes impaired glucose uptake in skeletal muscle resulting in a decrease in GS.

Figure 2: Data from F1 female (left column) and Dam (right column) average GS at 5mo in respect to Day (top row) and Treatment (bottom row) criteria.

What is an Academic Poster?

- A form of Academic Expression
- Summary of Research (5 – 10 minutes)
- Visually augmented discussion/interaction
- At conferences viewers come to you (or you can invite)
 - People search published abstracts
 - Posters may be grouped by field & folks may wander
- New Information
- Characteristic Fields
- Appearance/Content varies by Field or Lab



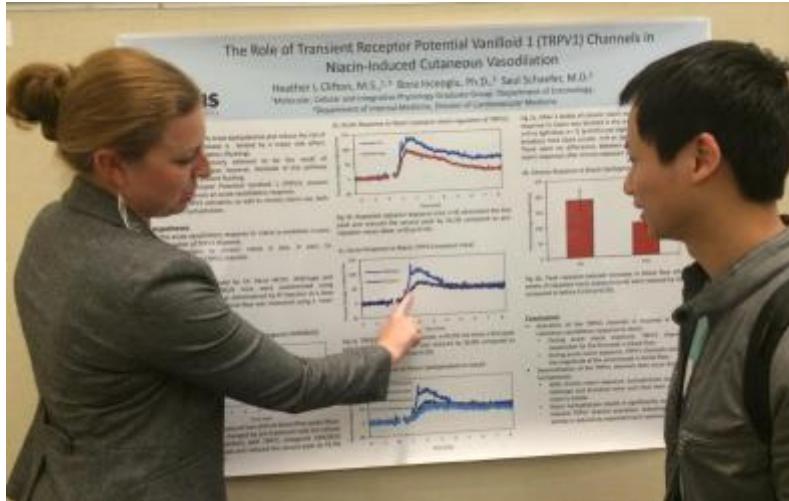
Why are Academic Posters Important?

- Represents you and your sponsor's research at:
 - Conferences
 - Symposia
 - Hallways
 - Informational Days
- Demonstrate expertise
- Demonstrate attention to detail
- Practice public speaking
- Learn about most current results in field
- Deepens understanding of topic
- Opportunity for teaching and learning
- Share ideas
- Create collaborations



Vital: Work with Your Sponsor

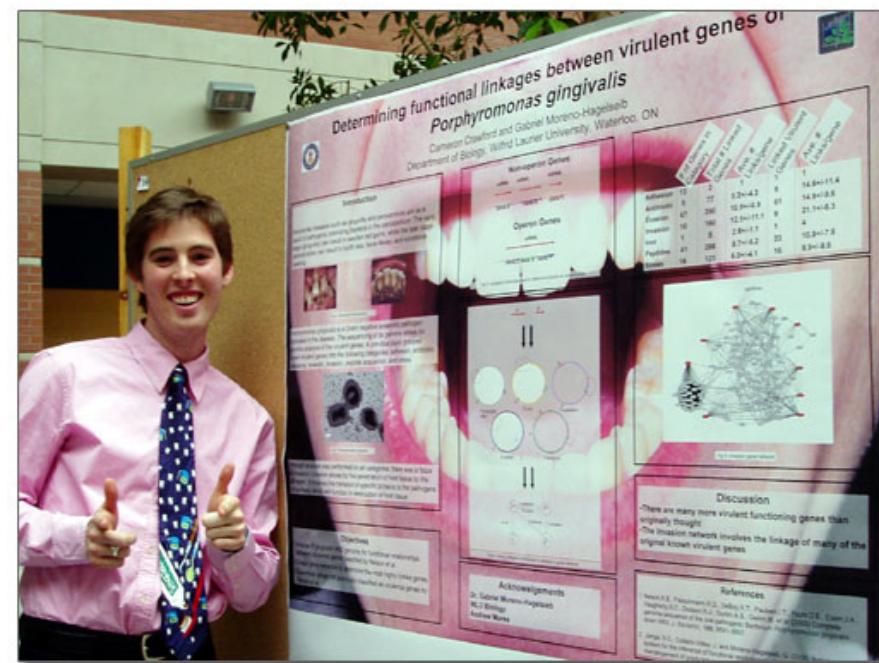
- Represents their laboratory
- They again need to be involved
- New data available – what should be included?
- Will want to make revisions (several times)
- Need final approval



Preparing Your Poster

Keep in Mind:

- Characteristic sections with expected information
- Consult rules of conference/rubrics
- Work in collaboration w/ research sponsor
- Decide on experiments that will be presented
- Create a storyboard/plan
- Visually appealing
- Primarily image driven but stand alone
- Simply and tightly written
- Know what to say for each figure
- Transitions between sections
- Practice for your audience
- KNOW all details of project
- Master questions



Your Audience will be??

- Researchers in your field will read even if bad
- Researchers in related fields easily persuaded to view
- Previously uninterested passers by can be attracted by a good poster
- ***You want to attract these people!***
- Don't vary content, vary explanation



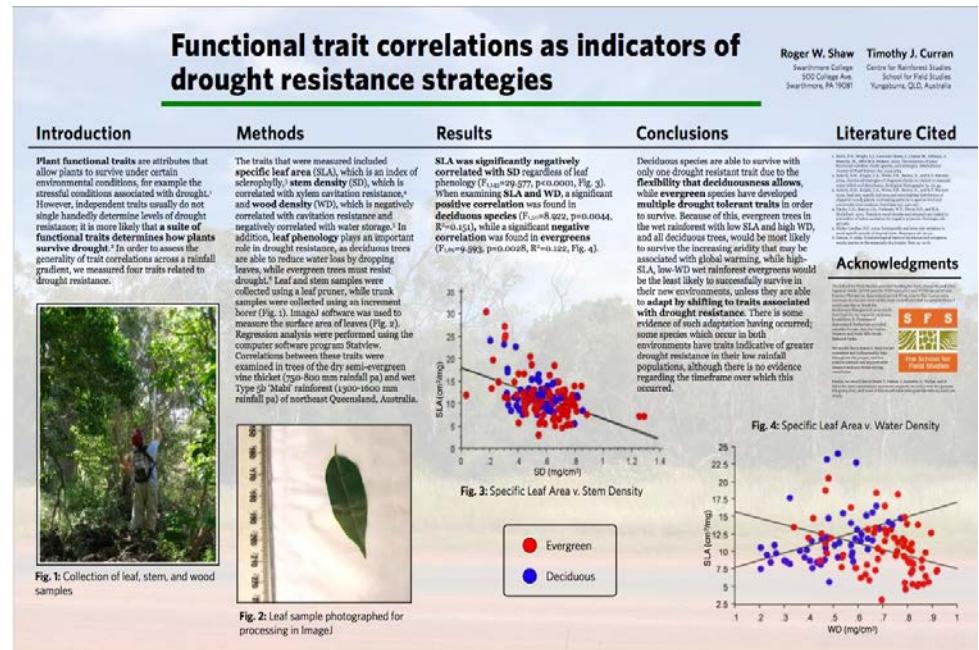
Main Elements of a Poster

- Title (same as submitted abstract)
 - Name and Campus
 - Core Technical Content
 - Abstract
 - Introduction
 - Results
 - Discussion
 - Literature cites/Resources
 - Acknowledgements
 - Visuals
 - Font should be legible fonts like:
 - Times New Roman
 - Arial
 - Garamond
 - Berkeley UC Davis Medium
- Do not use illegible fonts like:
 - *Brush Script*
 - Use the same font type throughout your poster
 - No smaller than 16 pt. font



Poster Appearance

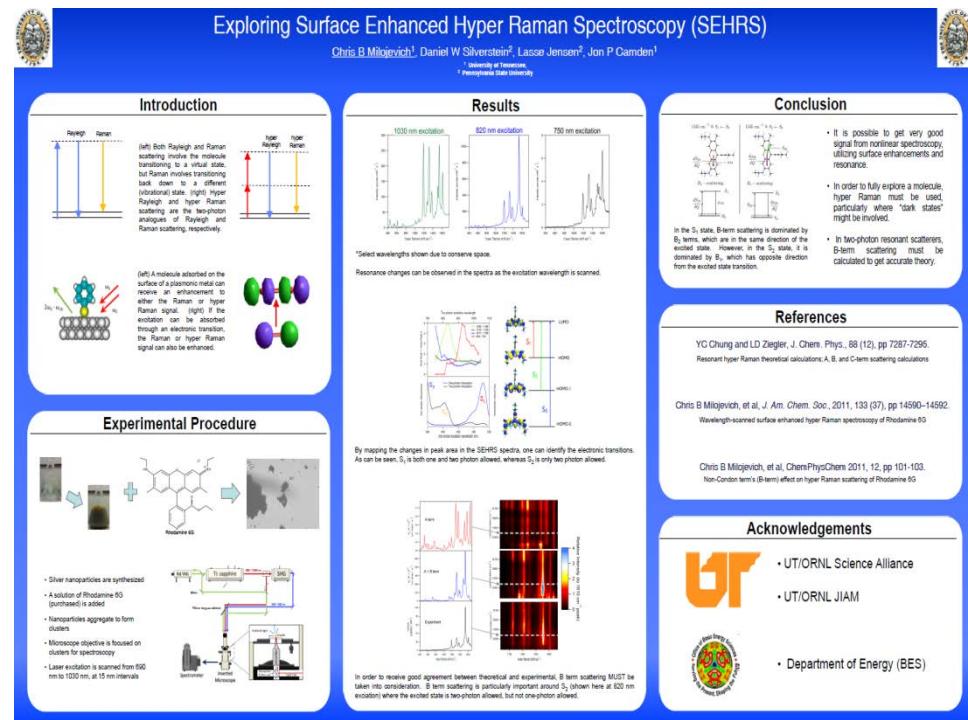
- Make rough plan of your poster
 - Will have “standard” headings
 - Poster provides visual aids as you talk
 - Picture worth 1K words
 - Carry information with colorful images and figures
 - Estimate space that will be needed –
 - How many experiments reported
 - How many figures needed?
 - What types of figures?
 - How much text to explain
 - Space for text
- Poster must be “stand alone” (understandable in halls, unstaffed)
 - Has to have words
 - Word amount varies with field
 - Balance your text and images



Poster Appearance

- 36"x48" good for 3 column (Proposal or one experiment).
- Intro - Can have image of existing model, or eye catching photo
- Methods - can be a flow chart
- Results – Figures, Line Graphs common.
- Discussion – Often bulleted
- Should be Visually Appealing
- Understand reader “gravity”
- Top left to bottom
- Left to right
- Have an obvious flow
- Headings
- Numbers
- Use “white space” or color frames to organize

- Unobtrusive/Neutral backgrounds
 - White
 - Lt grey
 - Lt beige



what is a visual hierarchy?

“The visual organization of elements within a design format to establish focal points based on their importance to the message to be communicated”

“The organization and prioritization of content as a means to communicate a message”

“Using color, contrast, texture, shape, position, orientation, and size to organize elements in a way that gives users a sense of visual importance”

why use a visual hierarchy?

- humans are primarily visual creatures
- we tend to focus on **differences**, not similarities, when making comparisons
- this is a key consideration for designing an effective poster

POSTER = COMMUNICATION,

and

DESIGN = COMMUNICATION,

SO...

GOOD DESIGN = EFFECTIVE POSTER

*(assuming that your data isn't crap – but
there are ways to get around that as well)*

elements of a visual hierarchy

a visual hierarchy is constructed using some combination of the fundamental principles of graphic design

- negative/positive space
- contrast
- repetition
- proximity
- color
- alignment
- typography (not really a principle)

Visual Hierarchy

YOU READ THIS FIRST
You will read this when skimming
You will probably not read this on a skim
You will not read this. Unless a phrase is bolded

Psst... This is using "anomaly" to break the flow of the hierarchy. Cool huk?

The image shows a white rectangular box with a thin black border. Inside the box, the word 'Visual Hierarchy' is written in small black font at the top right. Below it, there is a bolded heading 'YOU READ THIS FIRST'. Underneath this, there are three lines of text: 'You will read this when skimming' (in italics), 'You will probably not read this on a skim' (in regular black font), and 'You will not read this. Unless a phrase is bolded' (in regular black font). At the bottom right of the box, there is a red handwritten note that reads 'Pst... This is using "anomaly" to break the flow of the hierarchy. Cool huk?'. A red arrow points from the word 'anomaly' in the note up towards the bolded heading.

negative/positive space

- the balance between negative (background) and positive (foreground) space in a composition is very important
 - too much negative space = incomplete or disassociated appearance
 - too little negative space = busy, cluttered, and difficult to read

cramming too much information into too small of a space is far and away the number-one mistake in academic poster designs

types of contrast

size



texture



position



shape



color

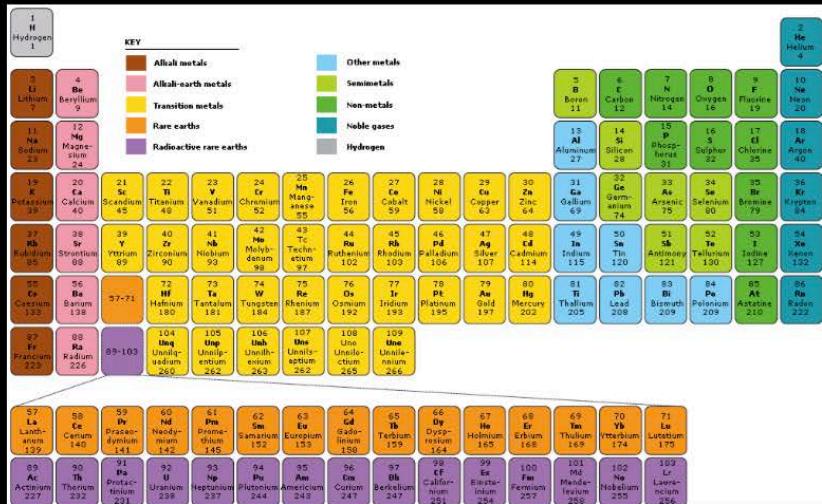


orientation



color

- color theory is an extremely complicated topic that could take up an entire class on its own
- for our purposes we will focus on two aspects:
 - color as an emotional tool
 - color as an organizational tool



color temperature – warm or cool?



color temperature - warm or cool?



color temperature

warm vs. cool colors

- warm
 - hues from red through yellow, including browns and tans
 - seem to advance or appear more active; often evoke feelings of happiness, optimism and energy, but can be visually overwhelming
- cool
 - cool = blue-green through blue-violet, including most grays
 - appear to recede into the background; usually calming and soothing, but can also express sadness

color as an organizational tool



Purpose:
To study iron protein biochemistry from the perspective of the iron
Protein = Ligand

TRANSFERRIN
A mechanistic study of the iron release by receptor-bound transferrin using spectroelectrochemistry

FERRIC BINDING PROTEIN
Role of a synergistic anion on modulating iron uptake in a bacterial transferrin by pathogenic bacteria: A study in kinetics and thermodynamics

HEMOGLOBIN
Effects of subunit cross-linking on hemoglobin oxidation states determined by spectroelectrochemistry

Duke University – Department of Chemistry – Durham, NC

The Iron Paradox
Iron is needed for nearly every living cell
Iron is toxic and can produce reactive oxygen species & must be controlled

Iron Abundance In Humans
45-55 mg/kg in humans
70% in Red Blood Cells (hemoglobin)
8.5% in Transferrin
However:
Turnover of transferrin iron is ~30 mg / 24 hours with 80% of this Fe being transported to the bone marrow for hemoglobin synthesis
Bacteria can also target Tf as a source of iron

Techniques:
Spectroelectrochemistry
UV-Visible Spectroscopy
Fluorescence Spectroscopy
Difference Spectroscopy
Stopped-Flow Kinetics
SUPREX

Transferrin
Spectroelectrochemistry utilizes a short pathway created by an OTTLE cell, to measure the variations in visible spectra as the analyte is oxidized or reduced by an externally applied potential. This technique is ideal for a biological analyte because only a small sample volume is required.

Heterogeneous reactions are complicated because the reaction can be limited by the product and/or the reagent physically close to the electrode surface. Mediators are used to act as electron shuttles

Iron located Tf binds to the human receptor and is released into the cytosol by endocytosis. Tf releases iron in the cytosol or the extracellular fluid. The mediators are acidic (Andrews, 1995). However, the chemical mechanism is unclear. The reduction potential of Fe³⁺ in the plasma (pH 7.4) and in the extracellular fluid (pH 6.8) is too low for biological reducing agents.

Reduction potential of Fe³⁺ upon receptor binding

The transferrin receptor is capable of shifting the reduction potential into the range accessible by biological reducing agents, allowing for a redox mechanism of Fe release. Transferrin not only supplies iron to mammalian cells, but has been identified as a target for pathogens to metabolically steal iron from their host.

How is Fe³⁺ removed from Tf when $K_m = 10^{-2} \mu M$?

Hypothesis: When transferrin binds to a receptor, the reduction potential shifts into a biologically relevant range.

Pyridine nucleotide reduction of Tf

Tf can be scavenged by receptors on the bacterial surface. FbpA is a nodal point in this iron acquisition process.

Both proteins utilize an exogenous anion

Structural Fe binding site similarity between Tf and FbpA

Reduction potential values by ~140 mV (14 kJ) based on identity of X.

Iron transport can occur by a redox or non-redox mechanism in the plasma. The thermodynamic stability and reduction potential are governed by the identity of the synergistic anion. Kinetically labile exchange is possible in the diverse anionic conditions of the plasma.

Line 1: FbpA requires a synergistic anion to facilitate tight IgM binding, which may play a role in ease and rate of Fe uptake by the bacterium.

1. FbpA acts as an iron binding protein

2. FeFbpA-X can exchange anions

3. Anion identity modulates both thermodynamic stability and redox potential

Fe³⁺ + FbpA-X → Fe²⁺FbpA-X

Thermodynamic stability varies by two orders of magnitude (14 kJ) based on identity of X.

Iron transport can occur by a redox or non-redox mechanism in the plasma. The thermodynamic stability and reduction potential are governed by the identity of the synergistic anion. Kinetically labile exchange is possible in the diverse anionic conditions of the plasma.

Chemically modified Hb

- Pyridylation
- Pegylation
- Conjugation to polysaccharides & proteins

HbA₂

-Intramolecular cross-linking

Combined Nernst Plot – Combined Hill Plot

E_{1/2} vs Log p_{O₂}

Implications

- Reoxygenating redox center not necessary
- Drive for cooperativity
- Structural perturbations
- Structural modifications perturb kinetics by altering exposure of heme cavity

Modified Hb Conclusions

Sample	E _{1/2} mV (NH ₄) ₂	Oxidation	Log P _{O₂}	Oxygenation
HbA ₂	83	1.2	-0.455	2.28
Hemoglobin	97	0.7	0.994	0.71
Des-BTC	94	0.9	0.818	1.40
OxyD ₂ BTC	106	0.9	1.028	1.11
aa-DBBP	125	1.0	0.461	1.58

Anaerobic Reduction Potentials

- Loss of cooperativity
- E_{1/2} potential increased vs HbA₂
- Normal physiological range
- Decreased tendency to form methb

Keller, Zik, Aszen, and Crimmins. (1998) *Inorg. Chem.* 37, 3664

Dhungana, Tobby, Anderson, Vaughan, Aszen, Meierhofer, and Crimmins. (2003) *PNAS* 100, 3639-64

Dhungana, Tobby, Zik, Levine, Crimmins, and Aszen. (2004) *Biochem.* 43, 205-6

Heymann, Weissen, Matzner, and Crimmins. (2000) unpublished

Dhungana, Anderson, Matzner, and Crimmins. (2000) *Biochem.* 44, 3905-18

Rouffell, Powell, Dhungana, Weissen, Matzner, Crimmins, and Flanagan. (2004) *Biochem.* 43, 15737-74

Dhungana, Tobby, Anderson, Vaughan, Aszen, Matzner, and Crimmins. (2003) *PNAS* 100, 3639-64

Bonaventure, Henkens, Weissen, Henrich, Pearce, Alayash, and Crimmins. (2006) unpublished

Tobby, Bonaventure, and Crimmins. (2002) *Meth. in Enzymology* 352, 187-209

Reiss (2001) *Chem. Rev.* 101, 2791-2919

a final word about color...

- color is an extremely powerful tool – use with caution!
 - using too much and/or too many colors drastically reduces effectiveness
 - a limit of 3 colors is usually recommended
 - but not always possible (think pie charts and the like)
 - however, it is possible to substitute pattern for color
 - also avoids potential problems with colorblindness in your audience (it's much more common than you may think)

proximity

- moving elements closer or farther apart to achieve a more organized look
- based on the idea that related items in close proximity will be perceived as a unified group
- your audience will respond by:
 - a) tending to naturally group similar items that are near to each other into a single unit, and
 - b) assuming that items that are not near each other in a design are not closely related to one another

alignment

- arranging elements so that they line up
 - creates order
 - organizes page elements; links disparate groups into a unified whole
 - satisfies the subconscious human desire to line things up (I'm not kidding, this is an actual thing)
 - creates imaginary visual connections

**ignore alignment at
your own peril!**

this poster has some serious alignment issues...

Salvage Archaeology at the Snake River Sandspit Site in Nome, Alaska

Concurrence of No Historic Properties:

• March 19, 1998 – The Corps sent a letter to the SHPO requesting concurrence that their project to improve the harbor at Nome, Alaska "does not have the potential to affect cultural resources."

• April 29, 1998 – The Corps received a letter from the SHPO, in which she concurred that "there are no historic properties in the area of potential effect."

Despite this, the Corps thought it was a good idea to have an archaeological monitor on site during the groundbreaking. A private archaeologist familiar with the area was subcontracted to monitor the initial construction during May 2005.



First evidence of the second house pit (Locality B), discovered by Corps archaeologist Megan Grover and bulldozer operator Mike Ulrich.

Discovery of the Site (Locality A):

• 1st week of May, 2005 – The subcontracted archaeologist identified the remains of a semi-subterranean house pit while monitoring the construction.
• The archaeologist took photographs and recovered approximately 25 artifacts, then decided that the house pit was ineligible for inclusion on the National Register of Historic Places and allowed the bulldozers to push the remains into the ocean.

• May 14, 2005 – The Corps received a letter from the subcontracted archaeologist mentioning the discovery and subsequent destruction of the semi-subterranean house pit.
• May 26, 2005 – The Corps sent a letter to the SHPO stating that the house pit is "not eligible for the National Register for Historic Places" because it "has lost integrity of design, materials, workmanship, and association."

• September 27, 2005 – The Corps sent a letter to Nome Eskimo Community (NEC), apologizing for not considering after the discovery of the site and stating that they will continue to work with the tribe to mitigate the damage done.

• October 28, 2005 – The SHPO sent a letter to the Corps in which she concurred with the "finding that the house pit no longer retains sufficient integrity to be eligible" and agreed that "appropriate mitigation could include the development of interpretive signs that discuss the Native history of the Nome area."

Nome Eskimo Community tribal Elder Al Zahn and Corps archaeologist Helen Linsenthal, excavating house pit B while construction of the revetment rock continues nearby.



Continued Discovery of the Site (Locality B and C):

• July 2006 – The Corps sent one of its own archaeologists, Megan Grover, to monitor the continued project construction.
• July 26, 2006 – Megan identified the remains of a second semi-subterranean house pit. She called the SHPO and left a telephone message about the discovery of the house pit, along with her contact information. She also contacted the City of Nome, Nome Eskimo Community (tribe), and Bering Straits Native Corporation. She called the SHPO again and spoke with a Review and Compliance Archaeologist at the SHPO's office, who agreed that she should excavate a test pit and do some shovel screening to identify the boundaries of the feature.

• July 27, 2006 – Megan called the SHPO again and left another telephone message about the site.
• July 28, 2006 – Megan called the SHPO again and talked with a Review and Compliance Archaeologist at the SHPO's office. Megan told the SHPO archaeologist that she was assuming the site was eligible for the National Register, and that she was going to excavate at least 50% of the site.

• August 3, 2006 – A meeting was held in Nome between the Corps, the Nome Eskimo Community, and the City of Nome, with the SHPO participating via teleconference, to discuss the discovery of the site and what to do about it.



Proposed Mitigation (as agreed upon in the draft MOA):

- 1) Write a site report (Data Recovery Report)
- 2) Provide for an accredited museum conservator to visit the City's Carrie M. McLain Memorial Museum and assist in the conservation and curation of the site artifacts on display
- 3) Assist with the accessioning of site artifacts and archaeofauna (bagging, cataloging, and appropriate photography)
- 4) Provide a museum-quality display case to the City's Carrie M. McLain Memorial Museum
- 5) Present information learned from the site in a series of public lectures in Nome
- 6) Prepare a manuscript on information learned from the site that can be utilized by Nome teachers (grades 5-12)
- 7) Present information learned from the site to a conference of peers
- 8) Submit an article about the site for publication in a peer-reviewed journal (if not accepted, publish elsewhere)

Excavating house pit B while heavy machinery runs nearby. Nome Eskimo Community employee Karlin Itchook and City of Nome employee Meghan Tim Elyck.



Discovery of the hunter's cache at the middle. Nome Eskimo Community employee Karlin Itchook, Corps archaeologist Arianne Wilson, and others.



Excavating the middle. Corps employees Mack Cassell, Ory McConnell, Megan Grover, Nome Eskimo Community tribal Elder Al Zahn, Kawerak employees.



The Excavation:

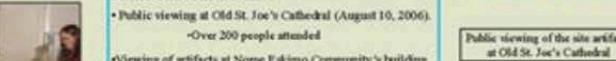
- Occurred from July 26, 2006 to August 26, 2006.
- Involved over 25 community volunteers, including:
 - City of Nome employees
 - Nome Eskimo Community (tribe) employees, members, and tribal Elders
 - Mr. Karlin Itchook, the tribe's Historic Preservation Representative, participated in the excavation every day
 - Kawerak, Inc. (regional non-profit Native corporation) employees
 - Interested Nome citizens
- Involved 6 Corps employees, including biologists and chemists as well as archaeologists and archaeology interns



Excavating house pit B. Nome Eskimo Community members Roger Johnson, Karlin Itchook, and Al Zahn, Corps archaeologists Helen Linsenthal and Mack Cassell, City of Nome employee Meghan Tim Elyck.

Public Outreach in Nome:

- Public viewing at Old St. Joe's Cathedral (August 10, 2006).
 - Over 200 people attended
- Viewing of artifacts at Nome Eskimo Community's building, for tribal members (August 2006)
- Viewing of artifacts at Kawerak's building during the regional shareholders meeting (August 2006).
- Another public viewing event at Old St. Joe's Cathedral (September 16, 2006)
 - Over 150 people attended
- Megan Grover gave a public lecture at the National Park Service's building (November 2006)



Public viewing of the site artifacts at Old St. Joe's Cathedral



Where We Are Today:

- Multiple drafts of the MOA have been sent out to signatories and concerning parties (on the following dates):
 - November 22, 2006
 - September 22, 2008
 - April 13, 2009
 - August 10, 2009
 - December 14, 2009
- After a statement meeting among the signatories to the MOA on December 15, 2009, and numerous unproductive meetings afterwards, advice was informally requested from the Advisory Council on Historic Preservation. On March 19, 2010, the ACHP sent the Corps an edited draft of the MOA.
- A new draft of the MOA is currently under discussion.
- Artifact and faunal analyses are being undertaken by Corps archaeologist Kelly Eldridge, and the Data Recovery Report is being drafted.

a few classic font pairings:

Myriad Caslon

Myriad Black Minion

Franklin Gothic Demi Baskerville

Gill Sans Garamond

Franklin Gothic Medium Caslon

letter size

Q: how large should you make your type?

A: ***AS! LARGE! AS! POSSIBLE!*** THIS CANNOT BE OVEREMPHASIZED. MAKE IT AS BIG AS YOU CAN, THEN ADD ANOTHER 10% FOR GOOD MEASURE.

- *rule of thumb:* the smallest text on your poster should be clearly legible from 6 to 10 feet away
 - *at a minimum, type should be approximately:*
 - **72 points for titles**
 - **48 points for headings**
 - **24 points for body copy**

REMEMBER – THESE ARE MINIMUM VALUES!
BIGGER IS ALMOST ALWAYS BETTER
(within reason, of course)

Poster Overview- 36" by 48"

Sponsoring logo



Title: Should be seen from 4-5 feet away. Times New Roman or Arial, Bold, at 60-80 point text

Title Line 1 Title Line 2

Name Line (First, MI, Last)
Department of ?
University of California, Davis, 95616

Name: in 44 pts., bold
Department: 40 pts., bold
Institution: 40pts., bold



Institution Logo

INSERT ABSTRACT

Abstract: No more than 250 words

INSERT TEXT

INTRODUCTION

Heading: Legible font, bold, 44pts.
Section: Legible font, bold, 36 pts

INSERT FIGURE

Figure 1: 32 pts, bold

INSERT TEXT

RESULTS

Heading: Legible font, bold, 44pts.
Section: Legible font, bold, 36 pts

INSERT TEXT

METHOD

Heading: Legible font, bold, 44pts.
Section: Legible font, bold, 36 pts

INSERT FIGURE

Figure 2: 32 pts, bold

INSERT TEXT

DISCUSSION

Heading: Legible font, bold, 44pts.
Section: Legible font, bold, 36 pts

ACKNOWLEDGEMENTS
Legible font, 36 pts., bold

REFERENCES
Legible font, 36 pts., bold

First Thing First: The Title and Abstract

- The title of your abstract is very important
 - Reflect the content of the paper
 - Specific and Succinct
 - Use key words for indexing and for searches
- **250 Word Max**
- Includes the following:
 - The research question or problem
 - The methods
 - The observations
 - Analysis, assessment and implications
 - Major findings, results and conclusions
 - REVIEW WITH MENTOR

Abstract Example:

ANALYZING THE PHYSICAL INTERACTION BETWEEN Pch2 AND Cdc23 IN SACCHAROMYCES CEREVISIAE.

SOLIS, Ryan D., Senior, Neurobiology, Physiology, and Behavior Major, Dr. Sean M. Burgess, Department of Molecular Cellular Biology, University of California, Davis.

In sexually reproducing organisms, meiosis serves as a specialized form of cellular division that creates four haploid gametes from a single diploid cell. In prophase I of meiosis, homologous chromosomes physically interact by pairing and exchanging genetic material through recombination. This is followed by the separation of chromosomes during the first meiotic division. Inappropriate pairing and failed segregation of chromosomes can lead to improper chromosome rearrangements and aneuploidy. Furthermore, these errors can lead to birth defects, cancer and other diseases. In budding yeast, Pch2 protein is involved in a meiotic recombination checkpoint that is responsible for the proper segregation of chromosomes by arresting cells that show abnormal crossover patterns. To further investigate Pch2 functions, a yeast two-hybrid assay was used that tests for physical binding between Pch2 and potential interactors. The sequences isolated from positive interactors were compared to the yeast genome to search for homology between known proteins. Sequence homology search provided several possible protein interactors and from these results we have focused on conducting further studies with Cdc23. Cdc23 is an essential protein and part of a protein complex called the Anaphase Promoting Complex. This complex is known to participate in ubiquitination of targeted proteins involved in the progression through mitosis and the G1 phase of the cell cycle. Along with Pch2, we suspect that the APC may have a role in chromosome-protein structure. Currently we hope to use a GFP tag to view Cdc23 localization in the cell and create a meiotic null of the protein to further conduct studies to better understand its interaction with Pch2 during meiosis.

Title Example:

Does Perinatal Exposure to DDTs and the Development of Glucose Intolerance Promote Skeletal Muscle Deficiency?



Ciara Main₁, Michele La Merrill Ph.D₂
Department of Animal Science₁, Department of Environmental Toxicology₂, University of California, Davis



Introduction

- Or Background
- This is separate from your abstract!
- State the research question and significance of the study
- Include related current investigations
- If you are there, they won't read it so SAY IT!
- Get viewers interested
- Reason you chose to study
- Foundation for your work (Models)
- General topics to specific
- Equivalent to 1 double spaced 12 pt page
- Usually contain citations/references (cite!)
- May have Purpose and Hypothesis embedded
- Generally completes first column

INTRODUCTION

Various implant surface modifications, such as the application of hydroxyapatite (HA) coatings, have been reported to aid in accelerating osseointegration. These improvements in dental implant surfaces have allowed clinicians to replace missing dentitions more effectively and successfully in both fully and partially edentulous subjects. However, failures leading to implant removal still occasionally occur, and these failure occur either early following the installation of the implant or later when the implant supported reconstruction has been in function for various periods of time. In many instances, bacterial adhesion on implant surfaces has a strong influence on healing and long-term outcome of dental implants. In order to improve the life and success of implant therapy, there is a need to investigate the additive anti-bacterial effect in conjunction with the enhancement of rapid bone formation. Since the antimicrobial properties of the silver (Ag) have been exploited for a long time in the biomedical field, the objective of this study was to evaluate the initial anti-bacterial adhesion and osteoblast cell proliferation and differentiation on Ag doped HA coating surfaces.

Introduction

Francisella tularensis is highly infectious bacterium that causes the disease tularemia. *F. tularensis* has been classified as a potential biological weapon. There is currently no vaccine approved for human use, and its mechanisms of pathogenesis are poorly understood, in part because of a lack of genetic tools to study this organism.

• *F. tularensis* is divided into several subspecies, including the highly virulent (for humans) subsp. *tularensis*, the moderately virulent subsp. *holoarctica*, and the low virulence (for humans) subsp. *novicida*.

• A cluster of genes, the *Francisella Pathogenicity Island* (FPI), has been shown to be essential for *F. tularensis* virulence.

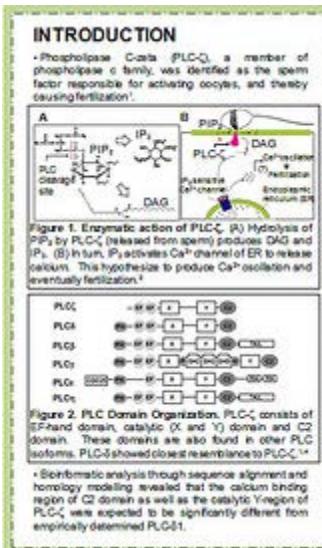
• The FPI is duplicated in subspecies *holoarctica* and *tularensis*.

• The IgG gene, located in the FPI, is essential for intramacrophage growth and virulence in mice.

• A lack of efficient genetic tools have hampered the study of subsp. *holoarctica* and *tularensis*. Moreover, the duplication of FPI genes has made the study of these genes in the more virulent subspecies cumbersome.

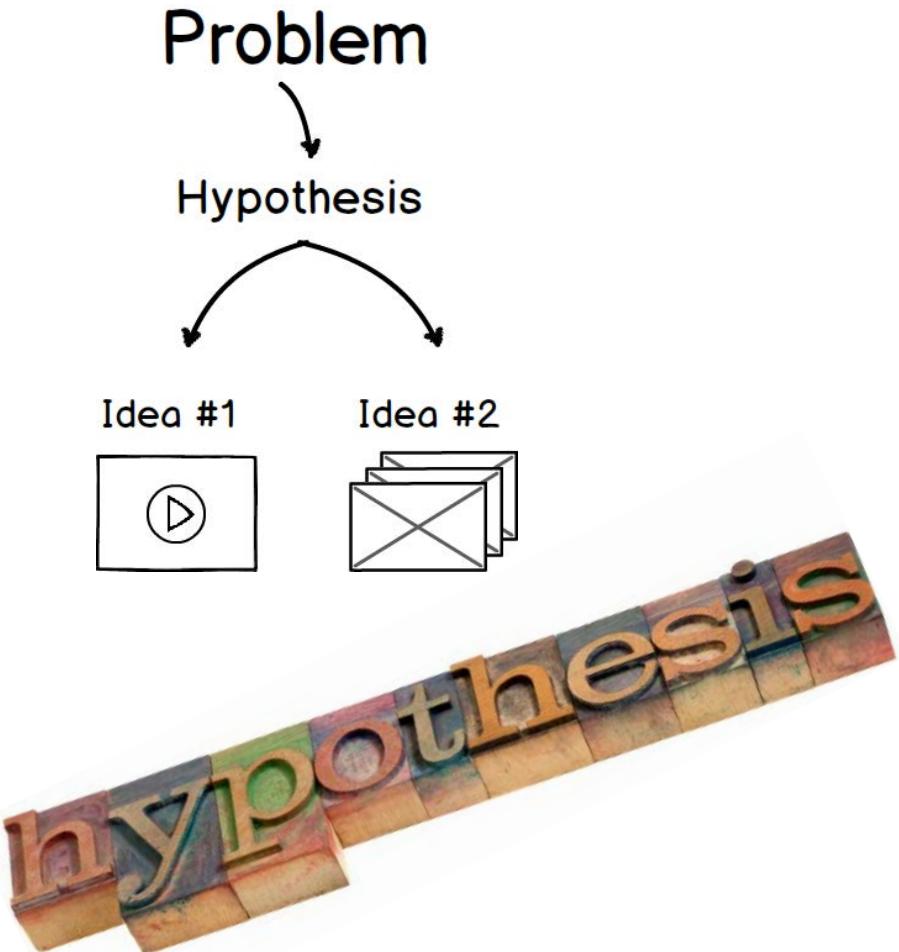
• We have developed a system for gene disruption in *F. tularensis* that utilizes a retargeted Group II Intron.

• This "Targetron" system works at high efficiency in subsp. *tularensis*, *holoarctica*, and *novicida*, and generates unmarked disruptions



Purpose and Hypothesis

- Can be embedded in Introduction, but
- Sometimes a separate section, to emphasize
- Purpose or Objective, Aim, Goal, etc.,
- Why you did experiment?
- “The purpose of this project...”
- Good for Student Conference
- (Promotes solid judging)
- Hypothesis
- Same as for abstract



Methods

- Describe procedures and methods in detail to allow observer to understand how, when, where data was obtained.
- Describe challenges and lessons learned
- Text with subheadings
- Can include a flow chart to summarize
- May include citations
- Make sure to include:
 - subjects
 - experimental design
 - drugs and equipment used
 - statistical methods
 - why you chose the method

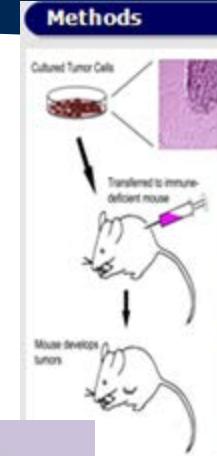
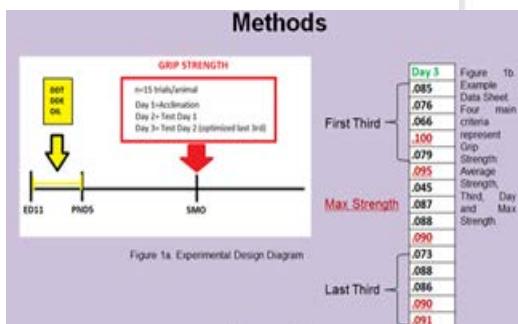


Figure 1. Animals were maintained on a 12:12 light-dark cycle and maintained on Purina mouse chow. MC-F-7 mouse mammary tumor cells (ATCC) were cultured in DMEM with 5% fetal bovine serum (Gibco-BRL) at 95% CO₂ in T25 coated flasks (Falcon). Cells were collected at 50% confluence and diluted to 10⁶ cell/ml in physiological saline (Hyclone). 0.1 ml of the cell suspension was injected subcutaneously into 5 regions of the back of nude mice. Tumors were allowed to develop for 30 days, and measured. Mice were separated into untreated, sham IP injected, high dose Compound-X (7 micrograms/gram wt) and low dose (2 micrograms/gram wt) groups, and then treated for 30 days. Animals were timed to judge their total daily time spent in grooming activities (Switzman Rodent Depression Test; Switzman et al. 1994), to assess possible depressive effects of the treatment. After 30 days, tumors were measured across their greatest width, both externally and after harvest. Results were analyzed using a student's T-test.

MATERIALS

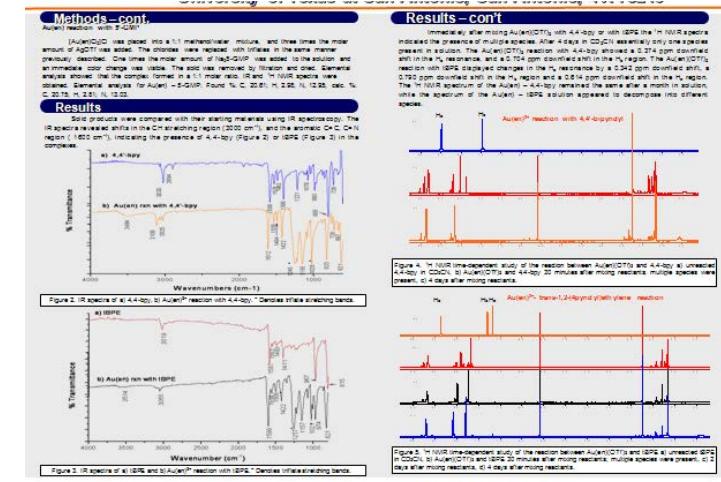
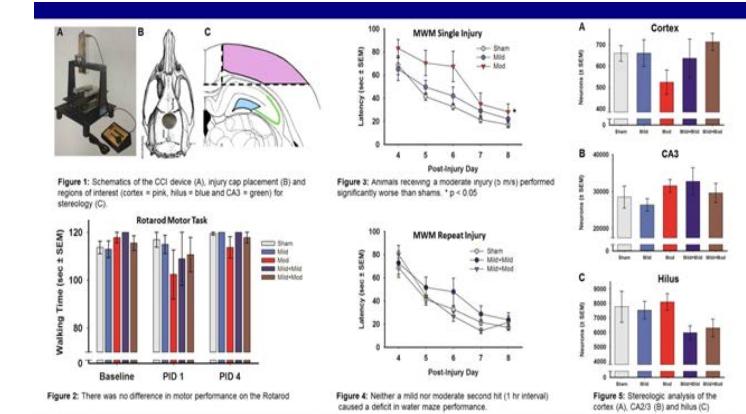
Coating process by Sol-gel methods: Commercially pure titanium (Ti) disks of (15 mm diameter and 2.0 mm thick) were used as substrates. All disks were wet ground with 240, 400 and 600 grit silicon carbide papers, followed by ultrasonic degreasing using acetone and ethanol for 10 minutes each. Deionized water was used for rinsing the disks between applications of each solvent. A passivation procedure was then conducted by exposing the Ti disks to a 40% volume nitric acid solution at room temperature for 30 minutes (ASTM F86-91).

Prior to coating on the passivated Ti surfaces, hydroxyapatite (HA) and 1 wt% silver (Ag)-doped HA (HA-AG) sol were produced. The HA sol was prepared by reacting calcium nitrate tetrahydrate [Ca(NO₃)₂·4H₂O] with methyl alcohol to produce calcium precursors. Phosphorus precursors were also prepared by reacting triethyl phosphite [(OC₂H₅)₂P] in 0.03 ml acetic acid (CH₃COOH). The two precursors were then mixed and 0.1 mol of DCCA (Drying Control Chemical Additive) was added to the mixture. All reactions were carried out in argon atmosphere. Similar to the HA sol, AgHA1.0 sol was produced by mixing the calcium and phosphorus precursors with 1.0 wt % silver nitrate (AgNO₃) and 0.1 mol DCCA. AgNO₃ was chosen for Ag doping because of the easy decomposition of nitrates during heating.

The prepared HA and HA-AG sol were then coated on passivated Ti surfaces by spin coating at 5,000 rpm for 50 seconds. The coated-Ti surfaces were immediately dried at 70°C for 12 hours, followed by a heat treatment at 650°C for 3 hours. The HA-coated surfaces were used as controls in this study. All samples were autoclaved prior to materials characterization and all culture experiment.

Results

- Largest section
- Vary with field
- Often two middle columns
- Summarizes the data and reports results of statistical tests and analyses (- or +)
- Draw implications and considerations
- Don't present raw data
- Make Image-based; use few words
- Maximize use of Figures
 - Make them simple
 - Must be easily seen
 - Make all lines wide enough
 - All text large enough!
 - Consistent axes across poster
- Minimize use of tables
 - Difficult to grasp quickly
- Use figure legends/captions as text
- Put text near figure it's describing
- ~1 paragraph per image/image group



Conclusions/Discussion

- Or discussion or summary
- Very few words
- Bullets good
- Bigger font if needed
- *Summarize “take home” results
 - Interpret the meaning or implications of your results
 - Mention any alternative explanation for results or unanticipated results
- *How did hypothesis work out?
- *Tie back to real world problem
- *Why Important/Implications
- Aim for:
 - Reasonable conclusions were given and strongly supported with evidence
 - Conclusions were compared to hypothesis and their relevance in a wider context was discussed

Conclusions

- We have adapted a group II intron-based system for efficient targeted mutagenesis of *F. tularensis*
- This system is effective and efficient across *F. tularensis* subspecies: *tularensis*, *holarsctica*, and *novicida*
- This system was used to successfully disrupt *blaB* found in single copy in the *F. tularensis* genome.
- This system was used to successfully disrupt both copies of the duplicated *IgIC* gene in a single manipulation.
- Targetrons should be a valuable genetic tool for the dissection of *F. tularensis* pathogenesis.

This study was supported by NIMH F31AI097956 to KDK and NIMH GM060425 to SAR.

SUMMARY AND CONCLUSIONS

In this study, x-ray diffraction analysis of Ag-doped HA thin film by sol-gel method indicated peaks corresponding to HA. Contact angles for HA-Ag surfaces were observed to be significantly lower when compared to HA surfaces. *In vitro* bacterial adhesion study indicated a significantly reduced number of *S. enterica* and *S. aureus* on HA-Ag surface when compared to HA surface, whereas significantly reduced adhesion of viable *S. aureus* was observed on HA-Ag surface when compared to Ti and HA surfaces. Additionally, no significant difference of osteoblast activity was observed on three different surfaces tested. Overall, it was concluded that the 1% Ag-doping on HA surfaces were non-toxic to osteoblast cells. Additionally, it was also concluded that the 1% Ag doping was effective in reducing bacterial adhesion.

References/ Literature Cited

- Include sources/resources that supported your work
- If someone's work is cited (usually in introduction), you must include a reference
- Generally “short” (title optional)
- Can use smaller font if needed

References

1. "Analysis of New York City Department of Sanitation Curbside Recycling and Refuse Costs." *Natural Resources Defense Council, DSM Environmental Services, Inc.*, May 2008. Web. <http://docs.nrdc.org/cities/files/cl_08052801A.pdf>.
2. Engle-Friedman, Dr. Mindy. "Baruch College of the City University of New York Waste Audit Report." *YRG Sustainability*, 14 June 2010. Web.
3. Divya Dayal, Macaulay Honors Intern of the Baruch College Sustainability Task Force. Interview conducted by Aaron Lam
4. "NYCWasteLess." *NYCWasteLess*. The City of New York. Web. <<http://www.nyc.gov/html/nycwasteless/html/home/home.shtml>>.
5. Survey Data from Chinatown, Flushing, and Fresh Meadows

References:

1. Capitman, John Amson. (2007). *Growing a Healthier San Joaquin Valley*. Fresno, CA: Central Valley Health Policy Institute.
2. Riordan, Deborah (2007, June). *Health Professional Shortages in the San Joaquin Valley: The Impact on Federally Qualified Health Clinics*. Presented at California State University Fresno, Fresno, CA.
Images borrowed from:
 1. Merced County. (2007). Merced County Supervisional Districts. Retrieved September 20, 2008, from <http://www.co.merced.ca.us/bos/district3.html>.
 2. Wikimedia Commons. (2006). Map of California highlighting Merced County. Retrieved September 20, 2008, from http://commons.wikimedia.org/wiki/Image:Map_of_California_highlighting_Merced_County.svg.

References

- [1] Rybanska-Kulczyk, T., Halmann, N., Sobiraj, G., Wolski, A. (2006). Quality and quantity of saliva DNA obtained from the self-administered Chelex method—a pilot study on the cohort of breast cancer patients. *Cancer Epidemiol Biomarkers Prev*, 15, 193-195.
- [2] Akola, N., Kivimaki, M., Suttorp, M., Miettunen, A., Collie, J.M., Veltin, S., Thors, H., Sted, K., Peterschmitt, L.A., McPherson, R. (2006). A PTF QDQF protocol for the collection of saliva for molecular analysis. *Anal Chem*, 78, 385-390.
- [3] Inaki, T., Da, T., Hwang, J., Kuroki, K., Iggy, H., Ni, Hirai, C. (2001). Comparison of high density genotyping results from saliva and blood samples on Affymetrix GeneChip Compatiblle SNP 5.0 arrays. *Am J Hum Genet*, 68, 103-110.
- [4] Rogers, N., Cole, S., Lau, H., Cross, A., Denny, E. (2007). New Saliva DNA Collection method compared to buccal cell collection techniques for epidemiological studies. *American Journal of Human Biology*, 19, 539-548.
- [5] Affymetrix, Inc. http://www.affymetrix.com/products_services/series/species_wise.asp?ref=Affy
- [6] Jindra, W. Koen et al., Integrated genotype calling and association analysis of SNPs, common copy number polymorphisms and CNVs. *Nature Genetics*, 38(12):1213-1220, 2006.

References

- Barry, J. (2005). THE EFFECT OF SOCIOECONOMIC STATUS ON ACADEMIC ACHIEVEMENT.
- Chevalier, A. (2005). The Impact of Parental Income and Education on the schooling of their children.
- Davis-Kean, P. E. (2005). *The Influence of Parent Education and Family Income on Child Achievement: The Indirect Role of Parental Expectations and the Home Environment*. Journal of Family Psychology Copyright 2005 by the American Psychological Association.
- Desforges, C., & Abouchara, A. (2003). *THE IMPACT OF PARENTAL INVOLVEMENT/PARENTAL SUPPORT AND FAMILY EDUCATION ON PUPIL ACHIEVEMENT AND ADJUSTMENT: A LITERATURE REVIEW*.
- Majorbanks, (1998). the increasing significance of class: the relative effects of race and socio economic status on academic achievement.
- Mickiewright, J. (2009). *Children's education and parents' socio-economic status: distinguishing the impact of mothers and fathers*.

References

1. Zhu, S.; Matilla, A., Tercero, J. M.; Vijayaragavan, V.; Walmsley, J. A. *Inorganica Chimica Acta*. 2003, 357, 411.
2. Zhu, S.; Gorski, W.; Powell, D. R.; Walmsley J. A. *Inorganic Chemistry*. 2006, 45(6), 2688.
3. Fujita, M.; Yazaki, J.; Ogura, K. *J. Am. Chem. Soc.* 1990, 112, 5645

Acknowledgements

- Acknowledge the faculty and staff who supported you.
- Thank people
 - Mentor
 - Research group
 - Technical assistance, etc.
- Reveal possible conflicts of interest
- Identify funding utilized
 - CAMP, LSAMP-NSF, NIH, etc.
- Font can be smaller than rest of text

Thank You!



Acknowledgements

We would like to thank Mr. Angus Rhododendrum and Suzanne McPerkins for their technical assistance.

Funded by NIH Grant #94-90082, the MBRS-RISE program (NIGMS #22209587), and the American Tobacco Association.

Dr. GP Taylor is a paid consultant for the Amelloron company, which has been licensed to develop Substance-X as a chemotherapeutic agent.

Acknowledgements

National Institute of Health (NIH-SCORE program, Grant No. GM-08194)

Partially funded by NIH/NIGMS MBRS-RISE GM6065

Acknowledgements

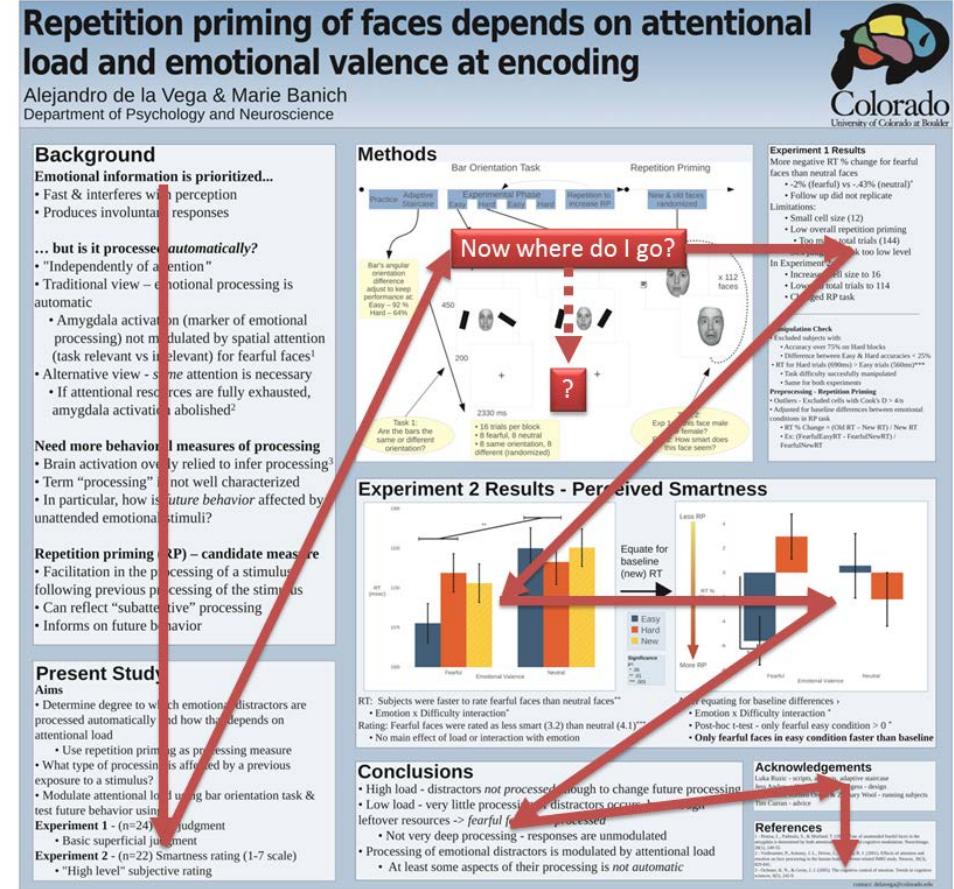
❖ We would like to thank:

- ❖ Our mentors Dr. Stergios Roussos and Dr. Maria G. Pallavicini for their support during the long and strenuous journey of establishing ITCH.
- ❖ All participating ITCH members whose hard work has made this organization a possibility.
- ❖ All community leaders, community professionals, and UCM faculty whose devoted time and patience has been greatly appreciated and has helped with the establishment of ITCH.

Remember to check that:

- All expected components are present, clearly laid out, and easy to follow in the absence of presenter
- The text is concise, legible, and consistently free of spelling or typographical errors; the background is unobtrusive
- The figures and tables are appropriate and consistently labeled correctly
- Photographs/tables/graphs improve understanding and enhance the visual appeal
- For ideas can go to Pimp My Poster:

<http://www.flickr.com/groups/688685@N24/>





High Resolution Reconstructions of Sea Surface Temperatures from Pacific Geoduck Growth Increment Chronologies

Matthew J. Stuckey¹ & Bryan A. Black²

¹University of California, Berkeley, Berkeley CA 94720, USA.

²Oregon State University, Hatfield Marine Science Center, Newport OR 97365, USA.

National Science Foundation Research Experience for Undergraduates

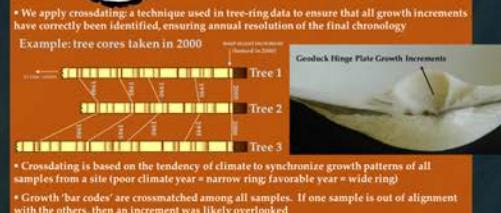
Hatfield Marine Science Center, Oregon State University

March 2008 Ocean Sciences Meeting, ASLO

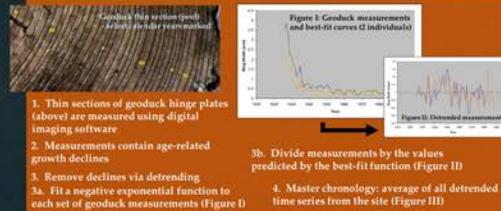
Introduction



Methods



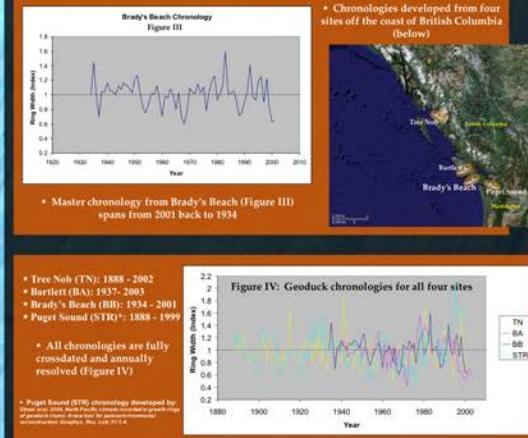
- Crossdating is based on the tendency of climate to synchronize growth patterns of all samples from a site (poor climate year = narrow ring; favorable year = wide ring)
- Growth 'bar codes' are crossmatched among all samples. If one sample is out of alignment with the others, then an increment was likely overlooked



Abstract

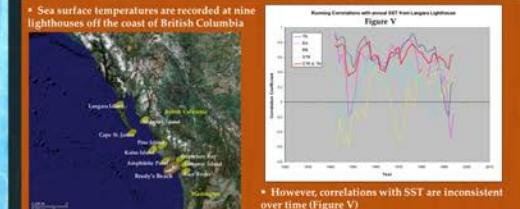
We demonstrate the potential for reconstructing sea surface temperatures along coastal British Columbia, Canada, using four chronologies developed from the growth increment widths of Pacific geoduck clams (*Panopea abrupta*). The four geoduck chronologies range from the southernmost to northernmost borders of British Columbia and were developed using standard tree-ring (dendrochronology) techniques, including crossdating. Although each geoduck chronology significantly correlated with local records of sea surface temperatures (SST), correlations were unstable over time. In every chronology, the relationship with SST would occasionally dissolve for a period lasting approximately ten years. The timing of these climate-growth breakdowns was inconsistent and varied among the chronologies. For any one chronology, inconsistent climate-growth relationships represented a significant complication for developing accurate SST reconstructions. However, when geoduck chronologies were combined via simple averaging, irregularities in climate-growth relationships canceled out one another to yield strong and highly stable SST reconstructions. Final SST reconstructions captured more than 60% of the variance in the instrumental record and extended more than 120 years, capturing the historical range of variability and providing context for current climatic trends.

Results

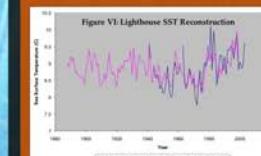


Discussion

- Sea surface temperatures are recorded at nine lighthouses off the coast of British Columbia



- Geoduck chronologies strongly correlate with SST records
- Potential tool for SST reconstructions



- SST reconstructions provide context for interpreting current climatic trends
- Geoduck chronologies can be further combined with those from trees, mussels, and fish (right)
- Potential applications:
 - Compare diverse ecosystems
 - Multiproxy reconstructions



Acknowledgements

- Many thanks to...
 - HMSC & OSU for hosting the REU program
 - NSF for funding this project under award OCE-0648515
 - Pacific Biological Research Station of the Department of Fisheries and Oceans Canada for providing our geoducks
 - Iitching Cheung, Dr. George Bondell, and many others at HMSC for shaping the REU experience
 - Ross Koenig for assistance with the Tree Rings and Bartramia methodologies
 - Avi Strom for developing the Puget Sound chronology
 - Dr. Bryan Black for his ongoing mentorship and tremendous help with this project
- For more information, please contact Matt at mstuckey@berkeley.edu or Bryan at bryan.black@oregonstate.edu

Examples of Excellent Posters

Does Perinatal Exposure to DDTs and the Development of Glucose Intolerance Promote Skeletal Muscle Deficiency?



Ciara Main¹, Michele La Merrill Ph.D²
Department of Animal Science¹, Department of Environmental Toxicology², University of California, Davis



Abstract

The once ubiquitously used pesticide DDT and its metabolite, DDE (together, DDTs) have been an environmental health concern for many decades. Recent epidemiological and mechanistic data link DDT exposures with devastating diseases such as obesity, hypertension, and components of Type 2 Diabetes. Our work surrounds perinatal exposure of DDTs and adult phenotyping. C57BL/6J mice were exposed to DDTs from embryonic day 11 to postnatal day 5, raised on normal chow, and switched to high fat diet (HFD) at 4 months to initiate obesity. Three months after exposure, dams exposed to DDE during pregnancy were glucose intolerant, while their female offspring displayed elevated fasting insulin. Disruptions in peripheral glucose utilization prompted us to explore whether tissues that rely heavily on glucose uptake were displaying a phenotypic defect. One month after being put on HFD (5 months after exposure), we measured muscle strength. To assess muscle deficiency, we tested forelimb grip strength (GS) using Chatillon Machinery Grip Strength Machine (Largo, FL). GS was tested over three days with 15 trials/day. On days two and three, overall grip strength, max strength, and first and last third of each trial were analyzed. Dams showed a difference in strength between days two and three, however F1 offspring had no significant change between treatment groups. Although, we did not find conclusive evidence that DDTs impair skeletal muscle function, further research is needed to examine potential indirect effects that DDTs may have on skeletal muscle.

Introduction

- DDTs are apart of a group of toxicants named Persistent Organic Pollutants (POPs) that accumulate in animal tissues.
- DDTs are a risk factor for glucose intolerance.
- One symptom to glucose intolerance is impaired glucose uptake in tissues.
- There is no prior evidence suggesting DDTs directly effecting Grip Strength in skeletal muscle.

Hypothesis

Perinatal exposure to DDTs causes impaired glucose uptake in skeletal muscle resulting in a decrease in GS.

Methods

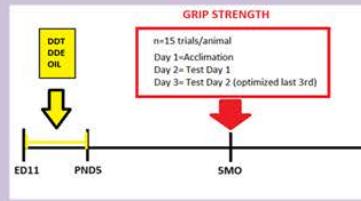


Figure 1a. Experimental Design Diagram



Results

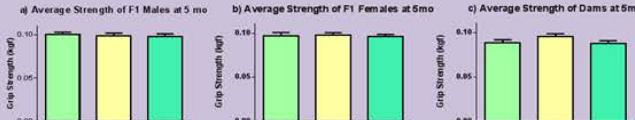


Figure 2. Average Grip Strength effects of F1 male (a), F1 female (b) and F0 dams (c) when separated by treatment.

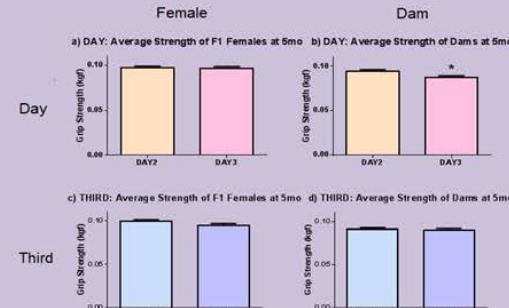


Figure 3. Data from F1 female (left column) and F0 dam (right column) average GS at 5mo in respect to Day (top row) and Third (bottom row) criteria.

Results continued

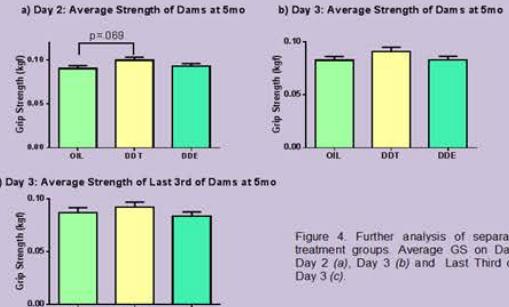


Figure 4. Further analysis of separate treatment groups. Average GS on Dam Day 2 (a), Day 3 (b) and Last Third on Day 3 (c).

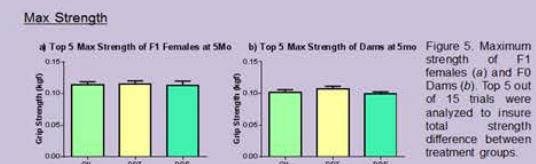


Figure 5. Maximum strength of F1 females (a) and F0 Dams (b). Top 5 out of 15 trials were analyzed to insure total strength difference between treatment groups.

Conclusion

- At 5 mos, DDTs did not effect GS regardless of sex, exposure type, or GS criteria (Avg. GS, Day, Third, & Max Strength).
- Dam GS on Day 3 (Fig 3b) decreased compared to Day 2.
- Given smaller SE and CV (data not shown) we conclude that GS measured on Day 2 is more robust than Day 3 due to possible decrease in endurance of Dam Day 3.
- Optimizing the Last Third on Day 2 is the best strategy to collect Grip Strength.

Acknowledgements

Extreme gratitude to Michele La Merrill Ph.D for giving me this opportunity to work in her lab. She has encouraged me to build novel skills as well as add upon existing. McNair Scholars Program and California Alliance for Minority Participation (CAMP) Program for providing me the resources for my future career in research.

Examples of Excellent Posters

Expression, purification, and crystallization of recombinant mouse phospholipase c-zeta (PLC- ζ)



BSc Genetics | School of Biosciences, Cardiff University, Cardiff, Wales CF10 3US



ABSTRACT

The aim of this study is to express and purify recombinant PLC- ζ protein for structure identification through X-ray crystallography. To date, there is no available empirical data of the 3D structure of PLC- ζ . The identification of the structure is crucial as it presents information that will facilitate understanding of the protein mechanism and regulation, both of which remained unknown. Bioinformatic analysis was also utilized to draw initial structural information, specifically on the domain differences of PLC- ζ , and empirically determined structure PLC- δ .

INTRODUCTION

Phospholipase C- ζ (PLC- ζ), a member of phospholipase C family, was identified as the sperm factor responsible for activating oocytes, and thereby causing fertilization.

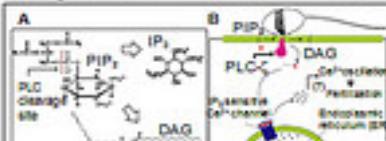


Figure 1. Enzymatic action of PLC- ζ . (A) Hydrolisis of PIP₂ by PLC- ζ (released from sperm) produces DAG and IP₃. (B) In turn, IP₃ activates Ca²⁺ channel of ER to release calcium. This hypothesis leads to Ca²⁺ oscillation and eventually fertilization.⁴

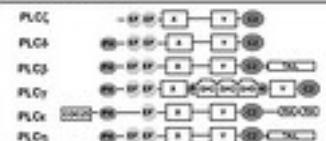


Figure 2. PLC Domain Organization. PLC- ζ consists of EF-hand domain, catalytic (X and Y) domain, and C2 domain. These domains are also found in other PLC isoforms. PLC- δ showed closest resemblance to PLC- ζ .⁴

Bioinformatic analysis through sequence alignment and homology modelling revealed that the calcium binding region of C2 domain as well as the catalytic Y-region of PLC- ζ were expected to be significantly different from empirically determined PLC- δ .

EXPERIMENTAL RESULTS

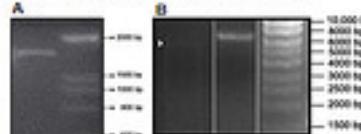


Figure 3. Molecular cloning of PLC ζ 124 construct. (A) Two step PCR amplification successfully produce a PLC- ζ construct with 6-HIS and 3C protease cleavage site (1813 bp in size). (B) Construct was ligated into pET102/D-TOPO vector. This is validated by restriction digest using *Ccl1*. Vector alone (1) showed a lower band compared to vector with the construct(2).

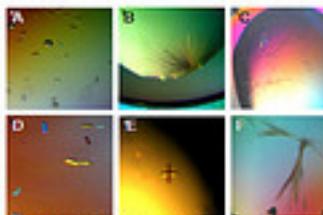


Figure 5. Crystallisation of PLC ζ 124 Construct. Six different screening methods were found to be suitable for crystallizing the protein. Crystals were confirmed to be protein due to birefringence characteristic under polarised light. Protein crystals A-E were needed to be optimised to obtain larger crystal. Protein crystal F was tested for X-ray diffraction. Preliminary analysis, however, revealed that X-ray diffraction pattern was hindered by presence of high salt concentration.

EXPERIMENTAL PROCEDURE

PLC ζ 124 construct was generated using two-step PCR to incorporate 6-HIS and 3C protease recognition site. Construct was ligated into pET102/D-TOPO vector and transformed into *E. coli* BL21(DE3). Protein expression was induced using IPTG. Bacterial lysis was carried out using French Press. Protein construct was captured using Nickel beads and cleavage of the protein from the tags was completed by 3C protease. Further purification was carried out using RP-HPLC (ion-exchange and gel filtration chromatography). Crystallization of protein was carried out using sitting drop vapor-diffusion method.

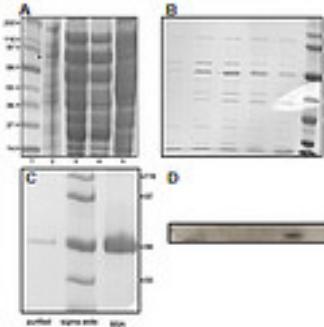


Figure 4. Protein expression and purification. (A) Molecular weight marker (lane 1). Protein bands after IPTG induction (lane 2). Protein construct migrated at ~83 kDa. Nickel beads were used to capture protein (lane 3) and the beads were washed with high salt concentration (lane 4) to remove contaminants (lane 5). (B) Fractions collected after cleaved protein (by 3C protease) passed through RP-HPLC-ion exchange method. Bands migrating at around 66 kDa (which corresponds to PLC ζ 124 protein) are found. (C) Further purification through RP-HPLC gel filtration method to obtain purified sample. (D) To verify that indeed the protein band is PLC- ζ , Western blot was employed using antibody specific to XY linker.

CONCLUSION

- It was predicted from the bioinformatic analysis that PLC- ζ will fold in the same general topology as PLC- δ (without PH domain).
- Specific differences were predicted to be in the Y-region of catalytic domain and C2 domain.
- This hypothesis, however, was not tested as X-ray diffraction data collection failed. This was due to presence of high salt concentration. Future study may need to alter buffer systems to obtain this structural data.
- The recombinant mouse PLC- ζ was successfully expressed, purified and crystallized. However, the expression levels is low.
- It was assumed that the protein was catalytically active in bacterial cell and overproduction caused toxicity and metabolic stress.
- To obtain higher protein expression, different vector system and bacterial strain maybe used.
- The ultimate aim is to reveal the 3D structure of human PLC- ζ . However, the expression of the human PLC- ζ was much lower. It is possible though to construct a more accurate model if an empirical 3D structure of mouse PLC- ζ was determined and used as a template.

ACKNOWLEDGEMENTS

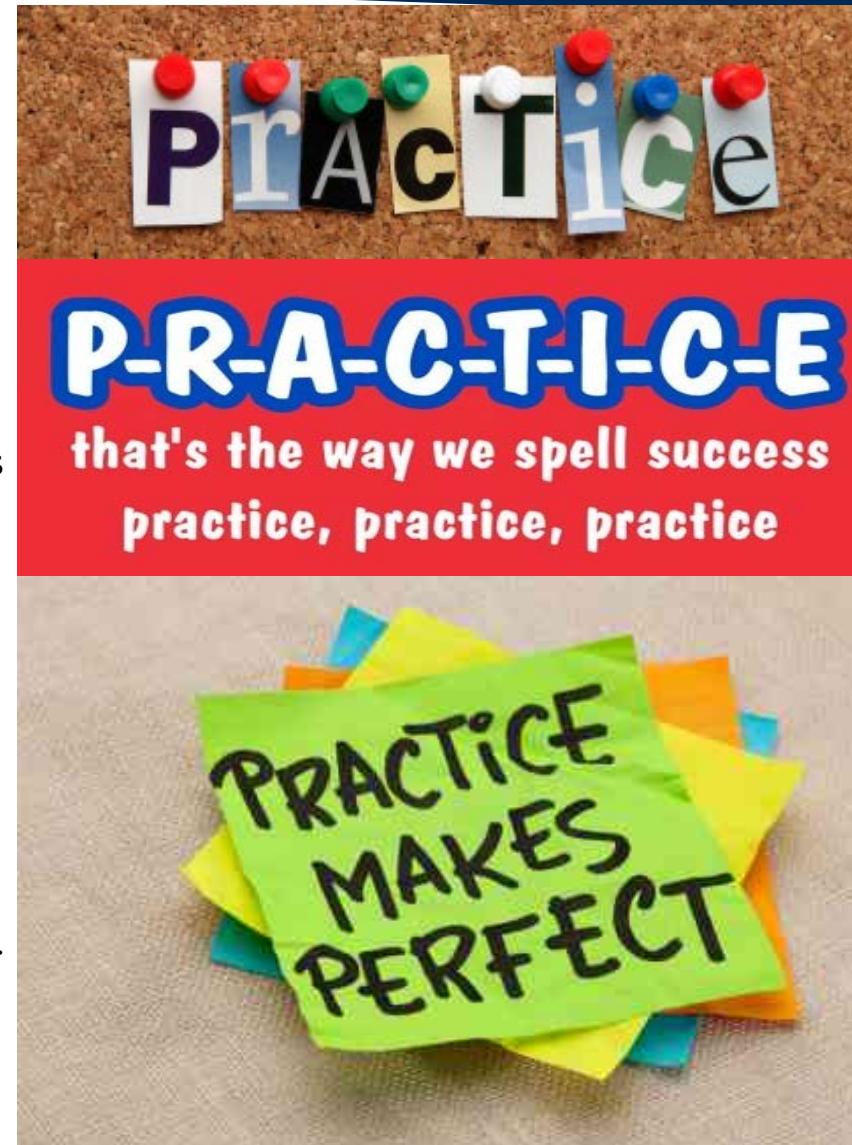
I would like to thank Dr. A. Rossbach for the antibody used in Western blotting, Dr. LO D'Cruz for the PLC ζ 124 construct, 3C protease and his supervision, Mr. Peter Wilson for technical support.

REFERENCES

1. Saunders CM et al. (2002) PLC- ζ : a sperm-specific trigger of Ca²⁺ oscillations in eggs and embryo development. *Development* 129, 3533-44.
2. Parmiter J, Lai FA, and Swann K. (1998) A novel protein for Ca²⁺ signalling at fertilization. *Gene Rev Dev Biol* 39, 203-206.
3. Duron-Segnouret L, Carot G, and Vuillard L. (2004) The toxicity of recombinant proteins in *Escherichia coli*: a comparison of overexpression in BL21(DE3), C41(DE3), and C43(DE3). *Protein Expression and Purification* 37, 203-206.
4. Essien LO, Persico O, Cheung R, Katan M, and Williams RL. (1996) Crystal structure of a mammalian phosphoinositide-specific phospholipase C delta. *Nature* 380, 595-602.

Practice Makes Perfect

- Finish early enough to practice
- MAKE SURE TO PRACTICE!
- Develop 5 minute presentation
- Know first sentence
- What to say for each figure (3 pts...)
- Transitions between figures
- What to point at for each figure
- Practice with lab mates and laypersons
- Run through ENTIRE poster
- Be friendly
- Don't sound like you've memorized
- Be excited about your work
- Remember to refer to your poster!
- They may interrupt with questions
- Pause long enough for them look at figure
- Know what questions may be asked....
 - Can practice them



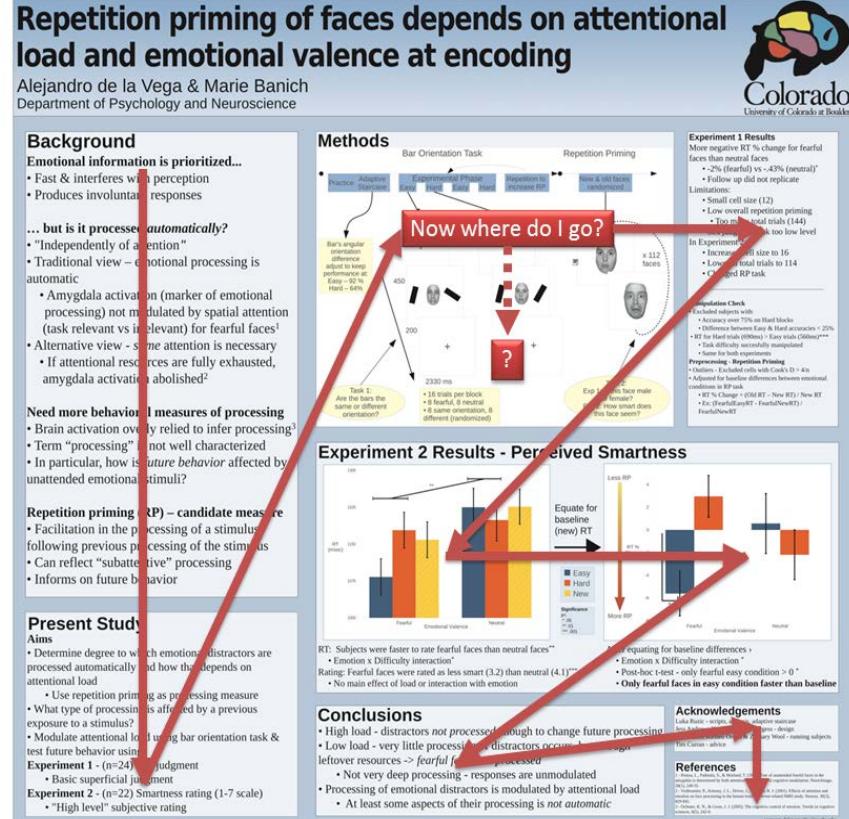
First Contact

- Stand to left of poster (where start reading)
- Take initiative
- Smile, but stay near poster
- If they come closer
- Say, “Hello” and shake hands
- Give name. Get their name.
- Give level, and university (UC Davis)
- Ask if they’d like “you to walk them through your poster”
 - YES? Then GO!
- This is work that I performed this summer in the ___ program in the laboratory of Dr. _____ at UC Davis.
- (Optional) Ask if they are familiar with this field of research
 - No- More introduction, careful with acronyms
 - Yes- Can go more quickly through intro



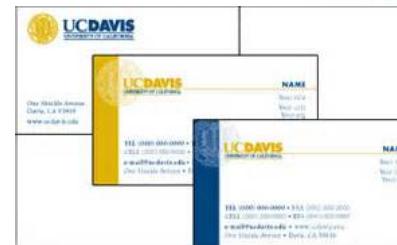
The Flow of Things

- Start with Intro that will catch them
 - No pointing if you have no figure!
- Move to Methods
 - Briefly summarize
- Move to Results
 - Longest section
 - Indicate at beginning if did not work
 - Walk thru all figures
- Transition to Conclusions
- Say Conclusions
- Acknowledgements (optional)
- Any Questions?



The Just in Case Items:

- Carry your poster with you at all times (do not leave as checked baggage)
- Dress for situation
 - Follow culture of conference
 - Student conference – suit...or minimally khaki's
 - Comfortable shoes
- Be there on time!
- Don't leave unless it is very important to do so (if so, leave a friend there momentarily)
- Mini-poster printed out
- Pins
- Water
- Business cards (check your email!)
- Notebook
 - Networking – write down ideas and names!



Remember

- If you network please remember to email them!
- Keep promises that you've made
- Hang poster outside your lab
- Sample posters can be seen online
 - google search
- A “template” can be found at:
 - <http://urc.ucdavis.edu/conference/index.html>



References and Sites to Visit

- How to Write an Abstract: <http://vimeo.com/3968357>
- How to Present: <http://www.vimeo.com/3968357>
- Click [here](#) for PosterTalk helpful presentation, which was used to create parts of this presentation. Thank you Dr. Gail P. Taylor!
 - Or visit:
http://r.search.yahoo.com/_ylt=A86.J7.Ct6FU_AIAj4wPxQt.;_ylu=X3oDMTByNzhwY2hkBHNIYwNzcgRwb3MDMgRjb2xvA2dxMQR2dGlkAw--/RV=2/RE=1419913218/RO=10/RU=http%3a%2f%2fwww.utsa.edu%2fmbrs%2fresources%2fcourses%2frescar%2fPosterTalk.pptx/RK=0/RS=8753.li dne73Y6qpS9cTFIPF8_0-
- Colin Purrington: Advice for designing scientific posters.
<http://www.swarthmore.edu/NatSci/cpurrin1/posteradvice.htm>
- Knowledge Management in Health Services; HSERV 590A: Creating a Poster Using MS PowerPoint – University of Washington
<http://courses.washington.edu/~hs590a/weblinks/poster.html>
- Creating Effective Poster Presentations – Hess and Liegel.
<http://www4.ncsu.edu/~grhess/posters/>
- University of Buffalo- Designing effective poster presentations
<http://ublib.buffalo.edu/libraries/units/sel/bio/posters.html>
- University of Kansas- Jeff Radel
http://www.kumc.edu/SAH/OTEd/jradel/Poster_Presentations/PstrStart.html

GOOD LUCK ON YOUR POSTERS!!

