Poster Workshop

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University of Wyoming
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URID Poster Session

URID Poster Session

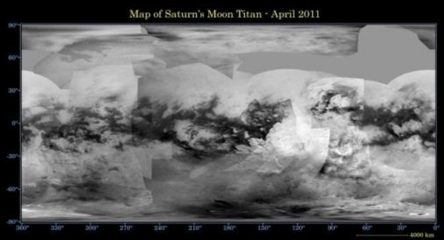
- 2-hour session (1:30 - 3:30pm)
- ~150 posters
- Self-paced walk through
- Diverse research
- Allow ample time to print!

- Introduction
- Poster examples
- Discussion
- Presentation
- Workshop

Poster Examples

- Take notes:
  - What is the first thing you notice?
  - Does the information flow logically?
  - Do the pictures/charts/graphs enhance the poster?
  - Are you left with questions?

- Discuss:
  - What were your initial thoughts/ideas?
  - What did you like?
  - Were there things you would change?
  - Do you feel you understand the research?

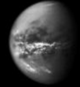


(Map of Titan and its lakes in a 936 nanometer visible filter)

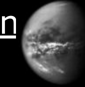
Introduction:

Our search for extraterrestrial life has so far been focused on finding water on exo-solar terrestrial worlds. This may hold true for carbon-based life forms with the six basic backbone chemicals for life, carbon, hydrogen, nitrogen, oxygen, phosphorus and sulfur because as far as we know, life can only evolve with an abundance of these chemicals and a steady environment to harbor life. (Bell, 2010) However, it is hypothetically possible for other chemical compositions to favor and catalyze radically different life forms, which would be a profound discovery. According to our current knowledge-base, we know little to nothing about life on distant worlds. These alien environments are just that, alien in nature. One inherent problem in our search has been the trend of looking toward the terrestrial planets to find carbon-based life like ours here on Earth, which is a very narrow search in universal terms. Right now, we are almost entirely examining the planet Mars and no other celestial body, which has proven to be beneficial in many areas of study such as; geology/geophysics, planetary formation, history of solar system and our origins/demise. Despite the obvious benefits, Mars has blindfolded our search for life. Its close proximity and theorized wet past has led a flow of curiosity in the science community but we are missing a major candidate(s) here in our own backyard, the moons. When examining Table 1 it is clearly evident that Saturn's largest moon is the most viable candidate for life in outer solar system exploration. This is true because of many reasons; mostly because of its rich organic nitrogen, methane, and hydrocarbon gas atmosphere that is ~1.4 Pa that of Earths and an atmospheric molecular mass that is 0.0012 away from ours (Refer to Table 1 for highlighted comparisons) Recently, we have unearthed much about the moon that has proven to arguably been some of the most exciting planetary geology and biology discoveries.

In 2004, Cassini-Huygens was the first probe to orbit and land on an outer solar system object, specifically Saturn's moon Titan. With our physical knowledge of Titans environment being ~8 years old, we are young in understanding the alien world. We do, however, have some understanding of the moon from previous ground based observations but no one knew how the system functioned. In 1944, the Dutch astronomer named Gerard P. Kulper discovered the absorption of sunlight by methane, an organic carbon based molecule (Burrati, 2012). We continued to use ground-based observations by X-ray and Infrared and found an incredible array of intriguing new natural processes. Titan was found to be the closest thing in our solar system to earth in many aspects, including the high probability for sustaining life. Over many years of steady observation we have discovered that the organic compound methane exists in a "triple point system," meaning it is found as a liquid, solid, and gas just as water exists here on earth, (Burrati, 2012). Exploring this system will advance our chances of finding unique biological life forms; meaning that we are not the freak occurrence biology wants us to be. The goals of this investigation are to connect the findings of many planetary scientists to the possibility that life forms build structures independent from our own. We will also examine the possibility of atmosphere and surface behavior inhibiting the growth of biological methanogen life forms.



Methanogen Life Forms on the Surface of Titan



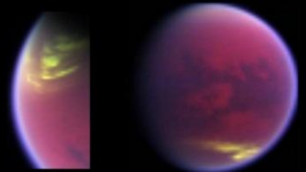
Niles Lathrop

Abstract:

Life as we know it consists of either photochemical or chemical processes based on Carbon and which primarily uses Oxygen as a vital part of cellular metabolism. However, that limited constraint is soon to be lifted as we discover new life forms based on Methane and Nitrogen, primarily on Saturn's largest moon Titan. Studies were done using Cassini/Huygens spacecraft and numerous other ground based techniques, but there is still much to be learned about the methane 'Goldilocks' world. We have found that there are many not yet accounted for chemical reactions where a loss and gain of certain elements is present, most notably the consumption of Ethylene, Ethane, and Hydrogen causing the increases of methane in the lower atmosphere. Titan's harsh environment allows for liquid methane on its surface, which we may think is a perfect environment for methanogen life to exist.

Name and size (Earth=1)	Mean Gravity (m/s^2)	Observed Mean Surface Temperature (K)	Atmosphere composition (% of Volume)	Mean surface Pressure (Pa)	Molecular mass of Air (kg mol^-1)
Mercury (0.383)	3.7	284.2	29.4 NA 22 He	10^-9	N/A
Venus (0.95)	8.836	737.2	96.5 CO2 3.5 N	9.2x10^6	0.0434
Earth (1)	9.798	287.6	78.08 N, 20.95 O2 0.93 Ar, 0.039 CO2	***98,888.20***	***0.029***
Moon (0.273)	1.622	154.3	No atmosphere	1.069x10^9	N/A
Mars (0.532)	3.69	182	95.3 CO2, 2.7 N, 1.6 Ar, 0.13 O2	685.4	0.0434
Titan (0.404)	1.352	93.7	98.4 N, 1.4 CH4, 0.2 H2	***146,700.00***	***0.0278***
Europa (0.245)	1.314	73.4	Very thin, O2	10^-7	0.032

(Table 1) Comparable factors that contribute to biological growth. Highlighted similarities.

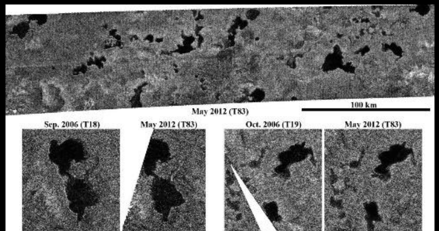


(Visible/Infrared image of Titans polar cloud system)

Results:

The Cassini spacecraft approached Saturn's largest moon Titan in anticipation for discovery. What it observed and photographed was the presence of a rich hydrocarbon orange haze that was impenetrable to many instruments. (Porco et. al., 2005) Geologists and Geophysics were unpleased because of the absence of visible features, but Astrobiologists and Planetary Scientists were intensely focused on now the only moon in our solar system with an atmosphere, Titan. Soon after, data was found showing copious amounts of Nitrogen (98.4%), Methane (1.4%), Hydrogen (0.2%), and ethane and propane gases in the Titans thick organic atmosphere. Not only did the abundance of gases intrigue scientists but the photochemical process creating many of these gases became a subject of much discussion and research, which has in turn led to the widespread speculation of a biological chemical process ongoing at the surface. Here on earth, life as we know it uses either sunlight or chemical energies. However, on the surface of Titan, there seems to be a disequilibrium or kind of missed calculation in the photochemical processes, as there are unknown processes that convert the scarce, Ethylene, Ethane, and Hydrogen into Methane. (McKay, 2005)

Being 94 degrees above absolute zero (-290 F), Titan is one of the coldest bodies in our solar system, (Cooper, 2011). This means liquid methane can and does flow on its surface generating large oceans, lakes, and rivers. Methane at this temperature exists as solid and gaseous forms as well, acting as ice and rain, exactly the same triple point system as water (H20) on our planet. Water is the most essential part of life as we know it, because water (liquid) is what holds our cells together. It allows organic compounds to swim freely to form biological organisms. This very well could be the case on Titan, especially because of its abundance of liquid methane on the surface. According to study McKay & Smith (2005), there is strong evidence supporting the possibility of methanogens (methane-based life) consuming rich hydrocarbons created by sunlight in the atmosphere reacted with hydrogen also present in the atmosphere. This methanogen life form would then expel Methane the same way we exhale Carbon Dioxide.



(Radar map of Titans northern "lake district")

Methods:

Data for this study were found by utilizing a wide variety of sources. The most significant sources included Science Direct journals, web based scientific articles, University of Wyoming's web of knowledge, and sources specific to planetary data used for table. Specific search criteria for sources were; "Atmospheric composition of Titan," "Methane based life forms," "Cassini/Huygens," "Life on Titan," and "Properties of liquid/gas/solid methane." Articles were first chosen by title and source reliability. A reliable source would be a NASA/Government funded organization or a team of scientists working closely with data found on missions such as the Cassini/Huygens probe. Secondarily, the articles were screened for having specific data on Titan and its relevance to this study. Key terms used in the screening included: atmospheric composition, details of a triple point methane, and biological laws pertaining to organisms not using the common six elements of life, etc.

Discussion:

The possibility for methanogen life forms would mean our search for extraterrestrial life is no longer limited to the existence of liquid water on the surface of celestial bodies, wither it be here in our system or other star systems. Liquid methane on the surface of Titan as well as the complex photochemical processes at work in the atmosphere boasts a strong candidate for life. When examining the possibility of life on the surface energetically, it becomes plausible that methanogen creatures consume C_2H_2 (Ethylene) and C_2H_6 (Ethane) as the most efficient energy sources, not just Hydrogen like previously speculated. Hydrogen alone is in actuality too scarce to become consumable by a biological process because if it were, then the molecular concentration level would drop significantly because of consumption, which is not the case (McKay, 2005). Other than the known photochemical possesses, there is still an un-counted for consumption and reaction occurring at the surface, one that involves Ethylene, Ethane, and Hydrogen with a discharge of Methane (Gilliam, 2011). As there is also an irregularly high amount of Methane (liquid, gas, and solid) on the surface, there must be another process producing such an abundant gas, which is why we are turning to the very stark possibility of methanogen life on Saturn's moon Titan. Methanogen life as we envision it would be slow and sluggish due to the extremely low temperatures and solubility of Methane, but evolution is tough as we see in many cases here on Earth. Methanogens could evolve by using catalysts to speed up reactions favorable to their extremely frigid environment (McKay, 2005). The only way to find out, is exactly that, find out. We are at a time where the need funding on the private and federal level for a new generation of high tech rovers and 'boats' to explore the only other lakes, oceans, and rivers in our solar system is critical. If we were to find life on another planet, in our solar system even, it would have profound implications on the planet we call home. A rover or boat as advanced as MSL (Mars Science Laboratory) would only cost upwards of $2.5 billion (Dreier 2012). Which in my mind is a small price to pay for the discovery of a new life form on the surface of Titan, one that is inherently methanogen in nature.

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Enhancing Bovine Mastitis Resistance through Genetic Engineering

Amanda Christensen

Introduction

Bovine clinical mastitis is an infection of the mammary gland and is the most detrimental disease in the dairy industry, costing dairymen in the U.S.A. alone billions of dollars every year. Many different pathogens cause mastitis, but one bacteria, *Staphylococcus aureus,* causes more than any other, triggering roughly 35 percent of clinical mastitis cases (Gianneechini 2002). While there are many effective treatments for mastitis caused by *S. aureus,* it is better to prevent mastitis than to treat it. There are several methods used to prevent mastitis, including, interestingly enough, genetic engineering. The purpose of this study is to examine the efficacy of genetic engineering as a tool for enhancing resistance to mastitis in cattle.

Methods

I conducted my research through internet search engines including Yahoo, PubMed, University of Wyoming Web of Knowledge, and the articles database within University of Wyoming's library. Search terms include:

- Bovine genetic engineering
- Genetic disease resistance
- Lysostaphin production
- Bovine genetic disease resistance
- Bovine nuclear transplant
- Bovine mastitis costs

Definition

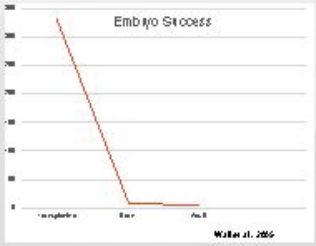
Bovine Mastitis- an infection of the mammary gland caused by bacteria that invade through the teat end and multiply in the udder. (Schroeder 1997)

Summary

In 2004, R.J. Wall and a team of researchers genetically engineered Jersey cattle to produce milk that contains lysostaphin – a protein that kills *S. aureus* bacteria – with the goal of producing cows resistant to *S. aureus* mammary infections. Wall and his researchers used microinjection and transplanted the gene for lysostaphin production from *Staphylococcus simulans*, a non-pathogenic relative of *S. aureus*, into the genomes of bovine embryo cells. Researchers then fused the genetically altered embryo cells with enucleated cow eggs. The resulting genetically enhanced calves produced varying amounts of the desired antimicrobial lysostaphin in their milk, and displayed mastitis resistance in various settings.

Genetic Engineering Process

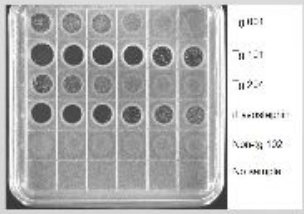
Results



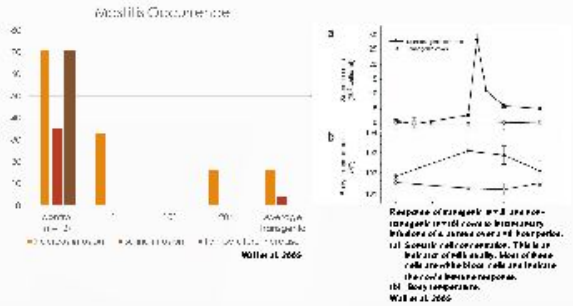
Lysostaphin Production

Animal ID	Micrograms/ml (avg.)
001	0.9
101	14
204	0.92

Wall et al. 2005



S. aureus colonies in the presence of milk from transgenic cows (001, 101, 204), lysozyme, and milk from a non-transgenic cow. Milk was spotted in the colonies are actively killed by lysostaphin-secreting colonies (Wall et al. 2005)



Response of transgenic and non-transgenic Jersey cows to intramammary infusions of *S. aureus* over 48 hour period. (a) Somatic cell concentration. This is an indicator of milk quality. Most of these cells are white blood cells and indicate the cow's immune response. (b) Body temperature.
Wall et al. 2005

Conclusion

- The gene for lysostaphin can be successfully transplanted the bovine genome, and expressed by lactating cows
- Cows producing lysostaphin in their milk are highly resistant to *S. aureus* mammary infections
- Cows producing ≥ 14 micrograms/ml lysostaphin are immune to *S. aureus* mastitis
- Lysostaphin-producing cows produce highly marketable, high quality milk due to the low somatic cell counts
- Lysostaphin-producing cows are not resistant to mastitis caused by pathogens other than *S. aureus*

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The Chemistry of Addiction

By Dylan Kriescher

"Once you've tasted excess, everything else tastes bland."
–Nikki Sixx

Introduction:

Over 22 million individuals have a substance dependence or abuse problem in the US (MyAddiction.com, 2010). This has grown rapidly from the 13 million in 2000 (Dawn Farm, 2006). Many are unaware of just how addictive some substances can be, particularly stimulants. Addiction is not simply the conscious desire for something, it is an inescapable cycle of need based upon chemicals in your brain, and willpower alone is not effective in reducing its hold.

"Neurotransmitters are the naturally occurring chemicals that transmit messages between nerve cells in your brain and throughout the entire nervous system. They are responsible for your mood, energy, and appetite and are necessary for every function your body performs. Proper levels of neurotransmitters are essential for stable moods, normal appetite and eating patterns, adequate sleep cycles, optimal energy, and the ability to be productive and learn." (NeuroWellness, 2008). Dopamine, the neurotransmitter responsible for pleasure and pain, is the neurotransmitter held most accountable for addictions. Substances such as cocaine increase levels of dopamine by preventing reuptake of dopamine. In this way it essentially blocks the reabsorption of dopamine while producing more and more of it, and this creates a phenomenon known as desensitization. Desensitization occurs when exposure to a drug causes less response than it did previously, this is also known as tolerance. At this point, where chemical and physical addiction become most prevalent, more and more cocaine is needed to produce the same "high" and stimulate the pleasure receptors as the initial smaller amount once did because the receptors are numbing out from the constant barrage of dopamine stimulus. It is the same as having to speak louder for a person whose hearing is impaired and damaged.

One cannot simply stop taking the drug for a few days and be "cured" of the addiction. A phenomenon called withdrawal occurs when there is a lack of the affect produced by the drug, creating a physical craving for the drug. The effects of withdrawal are painful and frustrating. There are two types of addiction which can affect the symptoms of withdrawal. There is and emotional addiction which is less based upon biological need but can be just as damaging to one's personal life, making the drug your primary goal. The other type is physical which is heavily based on biological need and less so on emotional. Physical addictions can be the most frustrating; you may know what the drug is doing to you but may be unable to stop and continue to take the drug to put off the effects of withdrawal which only increase the level of addiction. Emotional withdrawal symptoms may include anxiety, restlessness, irritability, insomnia, headaches, poor concentration, depression, and social isolation. Physical withdrawal symptoms may include sweating, racing heart, palpitations, muscle tension, tightness in the chest, difficulty breathing, tremor, nausea, vomiting, or diarrhea. The most dangerous symptoms can include Grand mal seizures, heart attacks, strokes, hallucinations, and delirium tremens (DTs) (Addictions and Recovery.org, 2010). It's easy to see how these effects could be unpleasant, and addicts trying to sober up have found it difficult to deal with. So they relapse, seeking the one thing that will save them from withdrawal effects and many times simply because they still crave the high, the same thing that got them into this mess in the first place. For example, the relapse rate for methamphetamines for example is 92% (Bartos, 2005). Treatment involving rapid clinical detoxification without further treatment often show no better results in longterm sobriety than those who are untreated. "Patients who go through medically assisted withdrawal but do not receive any further treatment show drug abuse patterns similar to those who were never treated." (NIH: National Institute on Drug Abuse, 2009).

The intention of my research is to discuss the nervous system in terms of the chemical processes involved with stimulant addiction. I also intend to point out the processes that are particular to each individual stimulant and discuss comparing their levels of addictability.

Methods:

I conducted my research through the internet search engines of Google, Google Scholar, PubMed, EBSCO Host, University of Wyoming Web of Knowledge, and the articles database within University of Wyoming's library. I did not include any source which was not relevant to addiction or the scientific process of it.

Search Terms:
(Process of) Addiction
(Process of) Dopamine (reuptake inhibition)
Neurotransmitters and Addiction
Addicting Stimulants
Cocaine, Methamphetamines, Nicotine, Ecstasy.
Neuron
(travel across) synapse, dendrite, axon
(effects of) neurotransmitter, dopamine (reuptake inhibitor), stimulant (drug), cocaine (reuptake),

Abstract:

This investigation's purpose was to study the chemical processes of the nervous system in terms of addiction for stimulants and find a common link. It was found that Cocaine, Methamphetamines, Ecstasy, and Nicotine increase dopamine levels in the brain, causing euphoric feelings and subsequently addiction by means of damaging the dopamine receptors and therefore a reliance on the effects produced by the drug. It is recommended that a study be conducted comparing the dopamine levels produced by each stimulant in order to produce a way of comparing the addictiveness of each stimulant.

Results:

The Synapse: Neurons are the building blocks of our brains, and an adult brain has approximately 100 billion of them. These neurons are cells that send messages to each other across the brain in order to perform functions. (Chudler, 2010). The way these neurons "communicate" is through the space between their dendrites, the arms of the neuron cell branched away from the center towards other neurons to act as a receiver, and axons, the main branch away from the main cell body that acts as the sender. (Cardoso, 2010). This space is called the synapse.

Neurotransmitters: A list of the most common and well-known neurotransmitters and their effects appears below. (Bora, 2010).

Acetylcholine
It is the first neurotransmitter to be discovered. This neurotransmitter is responsible for stimulating muscles. It activates the motor neurons that control the skeletal muscles. It is also concerned with regulating the activities in certain areas of the brain, which are associated with attention, arousal, learning and memory.

Dopamine
Dopamine is the neurotransmitter that controls voluntary movements of the body and is associated with the reward mechanism of the brain. In other words, dopamine regulates the pleasurable emotions, and drugs like cocaine, heroin, nicotine, opium and even alcohol increase the level of this neurotransmitter, for which the user of such drugs feels good.

Serotonin
Serotonin is an important inhibitory neurotransmitter, which has been found to have a significant effect on emotion, mood and anxiety. It is also involved in regulating sleep, wakefulness and eating. A significantly low serotonin level is found to be associated with conditions like depression, suicidal thoughts and obsessive compulsive disorder.

Gamma Aminobutyric Acid (GABA)
GABA is an inhibitory neurotransmitter that slows down neuron activity in order to prevent their over excitation, which could lead to anxiety. GABA is a non-essential amino acid, that is produced by the body from glutamic acid. Alcohol and drugs like barbiturates can influence GABA receptors.

Glutamate
Glutamate is an excitatory neurotransmitter. It is the most commonly found neurotransmitter in the central nervous system. Glutamate is mainly related with functions like learning and memory. An excess of glutamate is however toxic for the neurons.

Epinephrine and Norepinephrine
Epinephrine is an excitatory neurotransmitter, that is derived from norepinephrine. Epinephrine controls mental focus and attention. Norepinephrine is also an excitatory neurotransmitter and it regulates mood and both physical and mental arousal. Increased secretion of norepinephrine raises the heart rate and blood pressure.

Endorphins
Endorphins are the neurotransmitters that resemble the opioid compounds like opium, morphine and heroine in structure. In fact, their effect on the body is also similar to the effect produced by the opioid compounds. Like opioids, endorphins can reduce pain, stress and promote calmness and serenity. These are the neurotransmitters that enable some animals to hibernate by slowing down metabolism, respiration and heart rate.

Stimulants: "Stimulants are a class of psychoactive drug that increase activity in the brain. These drugs can temporarily elevate alertness, mood and awareness. While some stimulant drugs are legal and widely used, all can be addicting. While stimulants share many commonalities, each has unique properties and mechanisms of action." (Cherry, 2010). Many stimulants increase certain neurotransmitters in their own way to affect the user. The most common neurotransmitter affected by stimulants is Dopamine, the neurotransmitter responsible for perceiving feelings of pleasure. (See list of neurotransmitters above). Each stimulant increases levels of Dopamine or other neurotransmitters in their own way. (See list of some stimulants and their processes below).

[Reuptake Inhibition: The process of preventing the brain from reabsorbing and breaking down a neurotransmitter while the brain is still capable of producing more, thus increasing the level of the neurotransmitter. (Zhou, 2007).]

Cocaine: Cocaine binds to the dopamine reuptake transporters, thus blocking them from functioning. As a result, dopamine levels increase in the synapse, and consequently, the receiving neuron is continuously stimulated. This constant firing of the neurons leads to a feeling of euphoria. In addicts, cocaine blocks between 60 and 77 percent of the DAT binding sites; in order to attain a "high," at least 47 percent of the binding sites must be blocked by cocaine. (Farrenkopf, 2008).

Methamphetamines: Given acutely, methamphetamine increases dopamine levels in the synaptic cleft, mainly by inhibiting action of the dopamine transporter. Postmortem study has shown that chronic methamphetamine use results in reduction of dopamine transporter density [creating dependence on the drug's production of dopamine]. (Yoshimoto, 2001).

Nicotine: Nicotine imitates the action of a natural neurotransmitter called acetylcholine and binds to a particular type of acetylcholine receptor, known as the nicotinic receptor. In this way you have a higher than natural level of stimulation on this receptor that is responsible for attention and stimulation. This may explain why people who smoke believe they think better with a cigarette. (Dubuc, 2010).

Ecstasy: While ecstasy also potentiates the effects of norepinephrine and dopamine, it is distinguished from other psychostimulants by its strong affinity for serotonin transporters. The initial effect of ecstasy is thus an increased release of serotonin by the serotonergic neurons. The individual may then experience increased energy, euphoria, and the suppression of certain inhibitions in relating to other people. A few hours later, there is a decrease in serotonin levels. (Dubuc, 2010).

	Dopamine	Norepinephrine	Serotonin	Acetylcholine	Block Reuptake/Imitate NT /Increase Production
Cocaine	Increase	Increase	Increase	----------	Block/Increase
Meth-amphetamine	Increase	Increase	Increase	----------	Block/Increase
Nicotine	Increase	----------	----------	Increase	Increase/Imitate
Ecstasy	Increase	Increase	Increase	----------	Increase

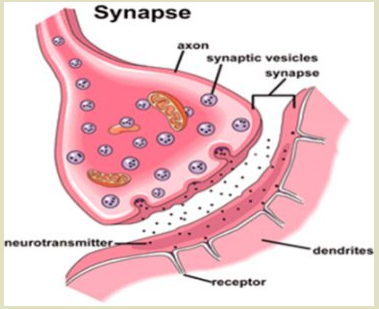

Image retrieved from:
http://scienceblogs.com/purepedantry/2007/03/neuron_to_glia_synapse_on_axon.php

Discussion:

The data shows that many stimulants may work in their own way to create addiction. In the end they all affect the neurotransmitter Dopamine, the neurotransmitter responsible for feelings of pleasure. This neurotransmitter is most responsible for causing addictions because when it is at increased levels, the receptors for it are damaged and weakened, resulting in needing more and more of the drug that increases it to produce the same effect, also resulting in a dependence on the drug because consistent use will stop the body from producing its own dopamine, relying on the drug to provide it. (Marohn, 2004).

Since we know that dopamine is a large part of the addiction process, we need a way to compare each drug to each other based on the extent they increase dopamine levels in the brain. We need a study that could compare how addictive drugs are based upon the levels of dopamine increased per amount of the drug; a single study with even controls across the experiment in order to accurately measure and compare these dopamine levels to each other. Even with the knowledge of dopamine's effect on the brain, no such study exists. With this knowledge we will understand the dangers of addiction and be able to predict how addictive new stimulants and pharmaceuticals have the potential to be.

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Assessing Science Literacy: Piloting the SLCI in Citizen Science Projects

Student Name; Student 2; Advisor 1; Advisor 2; Advisor 3

College of Education, Education Summit 2020

Biodiversity Institute

Science-Math Teaching Center

Celebrating 50 Years of Excellence at the University of Wyoming 1970-2020

Research Questions

1. What are the challenges of using the SLCI in citizen science projects?
2. How can the SLCI be adapted to fit citizen science assessment needs?

Methods

- Identify existing citizen science assessment tools and understand commonalities among learning outcomes of citizen science project development.
- Adapt the SLCI to address specific citizen science learning outcomes.

Spring 2019

Initial SLCI pilot: Biodiversity Institute BioBlitz and Moose Day

Fall 2019

Adapt the SLCI to measure demographics

Spring 2020

Final SLCI pilot: Biodiversity Institute Moose Day

Instrument

Science Literacy Concept Inventory (SCLI)*:* The SLCI is a 25-item concept inventory that uses a series of questions to calculate the science literacy level of undergraduate college students in general education science classes in higher education. The SLCI compares student learning outcomes in general education science classes to 12 concepts of citizen-level science literacy.

12 Concepts

1. Identifying a hypothesis
2. Importance of science literacy
3. Value of doubt
4. Selecting a hypothesis
5. Scientific "theory"
6. Importance of peer review
7. The need for reproducible experiments
8. Science's way of knowing rests on assumptions
9. Science vs. technology
10. Major historical theories
11. How modeling is used in science
12. Decision-making is important as science advances

Abstract

Recent studies demonstrate the need for more intentional assessment of science learning that happens during participation in citizen science projects. However, the citizen science community currently has few tools to assess levels of science learning for participants of the projects. In 2010, Nuhfer and colleagues developed the Science Literacy Concept Inventory (SLCI) to assess the impacts of college-level general education science courses on students' science literacy. This project uses this tool to address the need for science literacy assessment tools in citizen science by piloting the SLCI in citizens science projects and discussing the challenges and benefits of utilizing the SLCI in citizens science.

Background and Purpose

Several researchers have suggested that the act of engaging in citizen science projects strengthens participant understanding of the scientific process and, in turn, increases their science. However, few citizen science projects directly engage participants in all aspects or practices involved in the scientific process and there is currently no standard for evaluating impacts of citizen science on science literacy. Literature suggests new tools and techniques are needed to evaluate the learning outcomes of citizen science projects. The SLCI is a tool used in higher education to evaluate the science literacy of college level adults taking science courses with specific science literacy learning outcomes. Results from the SLCI showed improvement in students' science literacy after continued participation in general education science courses.

Instructors use the SLCI results to adapt their curriculum to better meet science literacy learning outcomes in higher education. The purpose of this research is to pilot the SLCI in citizens science projects to determine whether the SLCI could be a valuable tool in assessing the learning outcomes of citizen science projects. By adapting SLCI demographic questions to meet citizen science standards the SLCI will generate results specific to citizen science learning outcomes. And like higher education instructors, citizen science practitioners will be able to identify which of the science literacy concepts need to be considered when designing projects with science literacy learning outcomes.

Acknowledgements: Researcher, Researcher, Researcher, UW Biodiversity Institute, UW Science and Mathematics Teaching Center

Initial Findings

Demographics

- *Gender*: 61.5% Female, 38.5% Male
- *Education*: 63% science practitioners, graduate students, and professors
- *Ethnicity*: 92% Caucasian

Participation

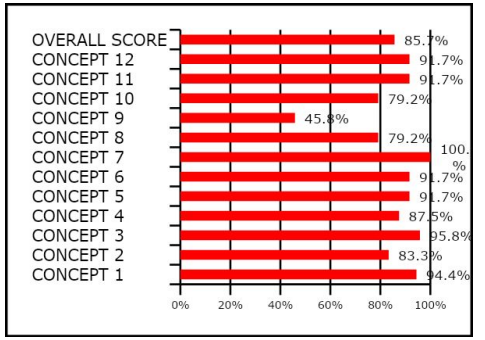
- *Amount*: 1-2 projects per year
- *Type*: Data collection online and in the field

Science Literacy

- *Overall score*: 85.7%
- *Highest Scored Concept*: 7
- *Lowest Scored Concept*: 9

These findings indicate the average citizen science participant understands the importance of using reproducible experiments but lack the ability to distinguish science from technology.

Percent of correct responses for each concept



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Discussion

- What are things you like or didn’t about the example posters?

Font Style

- **Times New Roman**
  is easier to read for blocks of text (serif)

- **Arial**
  is best for titles and for section labels (sans serif)

Font Style

Readable from 3 feet away

Section	***Font Style***	***Font size (points)***
Title of Project	Arial	80
Your name, mentor, dept, etc.	Arial	60

Section	***Font Style***	***Font size (points)***
Section Titles (Methods, Results, etc.)	Arial	54
Section Text (Hypothesis, Results, etc.)	Times New Roman	36
Acknowledge-ments	Times New Roman	26

The Title is Important

- Avoid vague, long, and/or jargon-heavy titles
  - Instead try a statement of findings
- Ex. – discovery of penicillin as an antibiotic
- Title: “Bacteria study” or “Penicillin study”
- Better title: “Effects of penicillin on bacteria”
- Even better: “Penicillin reduces bacterial infection”

Use Pictures & Graphics

- People are visual
- Communicates concepts
- Holds viewer's attention

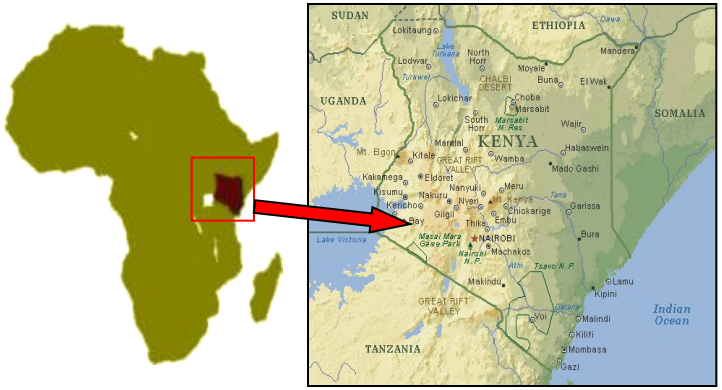


Figure 1. The Njoro Watershed located in southwestern Kenya.

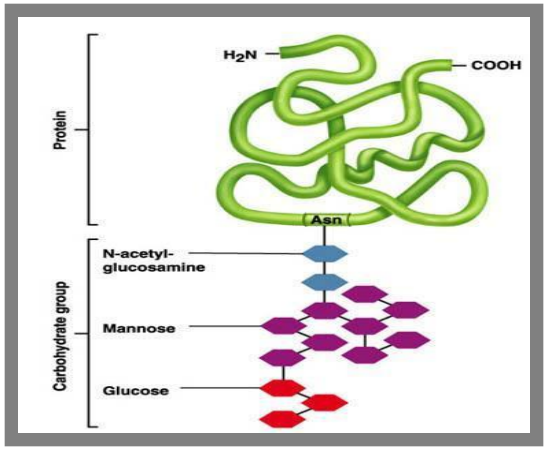
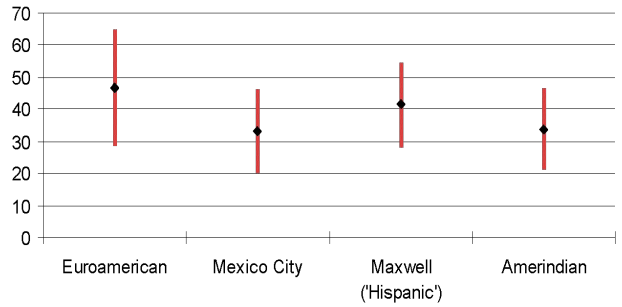


Figure 1. Glycoprotein

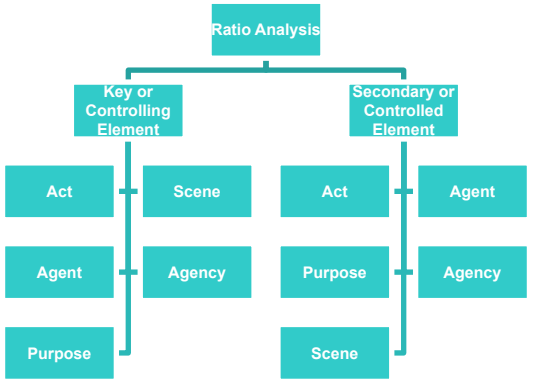
Use Charts & Graphs

- Make them simple
- Use color
- Label charts and graphs

Maxillofrontal Indices



Burkean Dramatistic Analysis



Limitations of the Poster

- Your poster is not your presentation; it is only a visual aid
- Articulating your ideas is as important as the poster itself
- Plan a short oral presentation for your poster

Oral Presentation

- Prepare overviews:
  - 30 seconds – your Elevator Pitch
  - 2 minutes
  - maybe even 5 minutes
- Be able to explain:
  - Context of research
  - Objective of study
  - Significance of results/graphics
- Ask if there are questions
  - You should be able to answer the “So what? Why should I care?” questions.

Drawing People In

- As people walk by, ask:

"Would you like me to walk you through my poster?"

Poster Formatting

- Make the poster in PowerPoint
  - Add text boxes, figures, visuals
  - Check out posters in your dept for ideas
- Adjust the PowerPoint slide to the correct dimensions (URID: 45” x 45” max)
  - Design Tab
  - Page Setup
    - May need to adjust fonts, position of text boxes, etc
- Allow ample time to print!

UNIVERSITY OF WYOMING

Title

Researcher
Mentor
Department

Introduction

Highlight points from your literature review to serve as background/ introduction to your research topic.

Statement of the Problem

The purpose of this study was to determine the genes mediating Pediocin AcH .

Hypothesis or Objectives

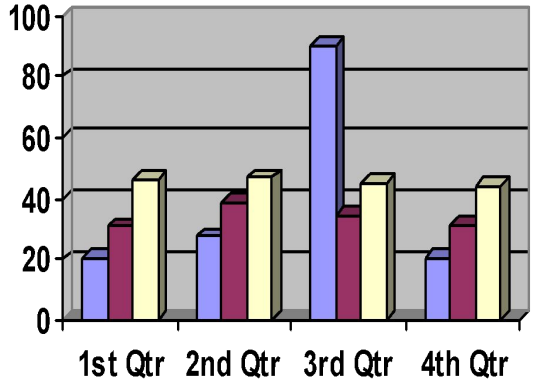
The objective of this study is to develop methods to control the food borne pathogen, *Listeria* by the use of an antimicrobial peptide.

Methods

This section focuses on the steps used to conduct your research.

•For ideas on what to include:
Consult with your mentor
Look at journal articles in your field
Look at posters in your dept

Results (Just the facts, no interpretation or discussion)



Results Are The Heart of Your Poster: When appropriate use charts, tables, and graphs. Accompanying text should support the graphics.

Discussion or Conclusions

Generally deal with 3 or 4 things.

1. Interpretation of data
2. Integration w/ what was previously known
3. Implications for future research study

Acknowledgements
including mentors, sources of funding

UNIVERSITY OF WYOMING

Title

Researcher , Mentor
Department

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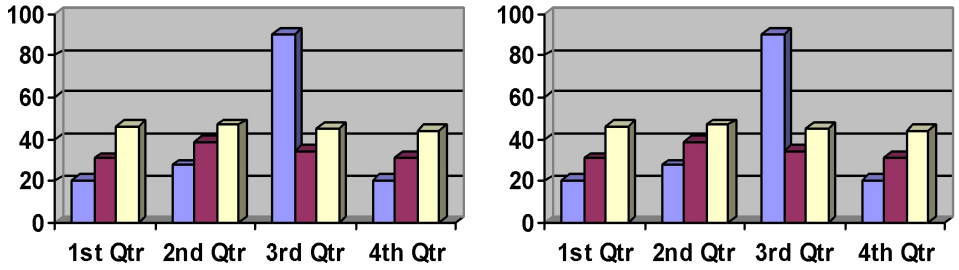

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Discussion or Conclusions

Generally deal with 3 or 4 things.

1. Interpretation of data
2. Integration w/ what was previously known
3. Implications for future research study
4. Importance of the work

References

Journal articles cited or important to your research

Acknowledgements

Including mentors, sources of funding

Posters 101

Dos

- Appropriate font
- Pictures/charts/graphs
- Short presentation of your poster
- Make poster in PowerPoint

Don’ts

- Too much text
- Font too small
- Too much/little blank space

Open Work Time

- Possible things to work on
  - Come up with a title
  - Figure out the "hook" for your research – work on storytelling
  - Find one or two essential figures, graphs, tables for you poster
  - Practice your presentation on others – then have the others tell you what your presentation was about.