2022 VIRTUAL CANNABIS RESEARCH CONFERENCE

Exploring New Cannabis Research Frontiers

AUGUST 8-10, 2022

PROGRAM BOOK

CannabisResearchConference.net

2022 VIRTUAL CANNABIS RESEARCH CONFERENCE

Welcome to the 6th annual 2022 Virtual Cannabis Research Conference (CRC) - an interactive experience!

This multi-disciplinary, three-day virtual conference brings together attendees from around the world from August 8-10.

The Cannabis Research Conference comprehensively explores the latest in cannabis science and innovation for applications in medicines, foods, materials, and textiles that can improve people's lives and better society.

This conference allows you to connect with the brightest innovators addressing the following program areas:

- Genetics, Growth, and Culture
- Human Health
- Quality Control, Chemistry & Analytics
- Livestock and Companion Animals
- Business and Economic Development
- Education, Extension, and Training
- Policy and Legal Landscape
- Materials and Product Manufacturing

This virtual research conference will focus on unique and timely topics and will feature more than 100 live and on-demand presentations and a interactive poster hall.

There is no better time or place to connect with cannabis experts from around the globe while actively planning new research and business ventures.

THE HOSTS

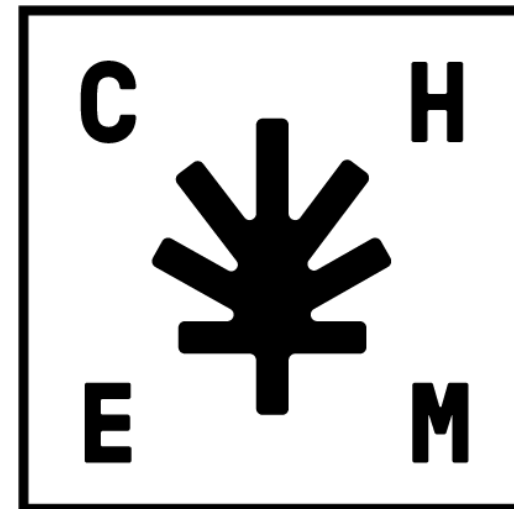This is the nation's most innovative collaboration
in cannabis research...

Oregon State University
Global Hemp
Innovation Center

Institute of
Cannabis Research
COLORADO STATE UNIVERSITY PUEBLO

In Partnership With

C H
E M

Oregon State University's (OSU) Global Hemp Innovation Center is home to the world's leading experts in hemp research. The largest of its kind in the nation, it promises to advance the research of hemp and its market potential across multiple diverse industries and research fields to serve the growing international demand for innovative approaches to food, health, and fiber. For more information about the OSU Global Hemp Innovation Center, visit agsci.oregonstate.edu/hemp.

The Institute of Cannabis Research (ICR) was established in 2016 at **Colorado State University Pueblo** becoming the first multi-disciplinary cannabis research center at a regional, comprehensive institution of higher education. The ICR supports and facilitates unbiased and innovative cannabis research in wide-ranging areas in the sciences, medical (including basic and clinical research), economic impacts, the social sciences, and other areas. In addition to its research efforts, the ICR also supports the dissemination of cannabis research results through a variety of mechanisms including this annual conference, the publication of the Journal of Cannabis Research, and a monthly webinar series. For more information about ICR, visit csupueblo.edu/institute-of-cannabis-research.

The **Cannabis Health Equity Movement (CHEM)** is a call to educate, advocate, and demonstrate that cannabis is a core solution to achieving health equity for all people beginning with communities most divested of access to full health and wellbeing. CHEM asserts that social equity is our vehicle while health equity is our destination. We believe that health equity should be the True North of not only the cannabis industry, but for all governments, public and private sector institutions, and individuals as we reimagine and create more prosperous societies for all people. Furthermore, we encourage utilizing the innovations of cannabis across the plant's agricultural, industrial, medical, and nutritional uses as a direct means of achieving it. For more information, visit chemallyance.org.
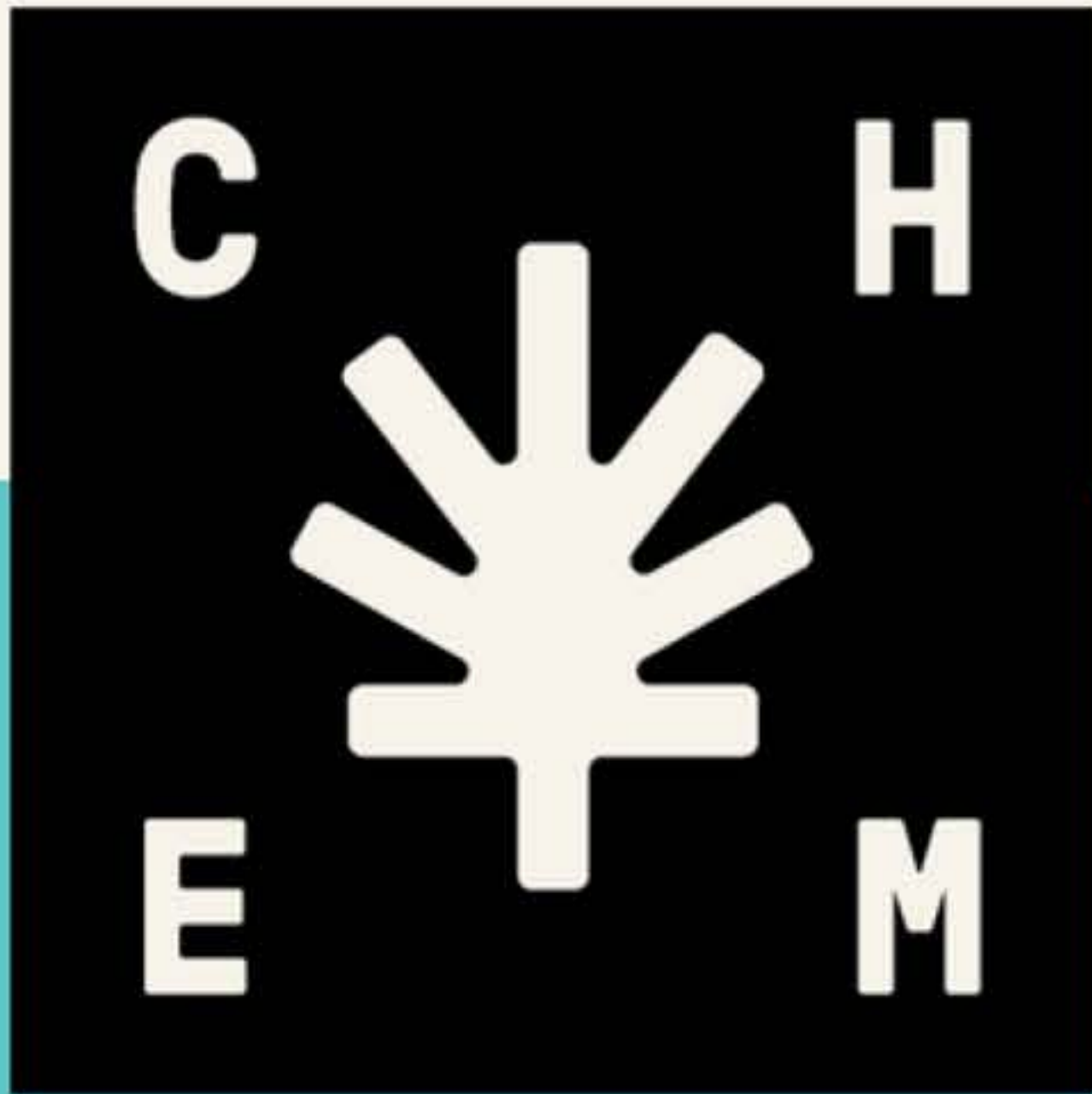
We are CHEM.

A call to educate, advocate, and demonstrate cannabis pathways to health equity.

Cannabis Health Equity Movement (CHEM)™

Thought Leaders. Cultivators. Innovators. Coalition

CHEM is a coalition of social equity agents pioneering paths across an array of related sectors including medicine, law, research, regulation and more, combining forces to cultivate and the next generation of cannabis leaders and transform communities devastated by the War on Drugs.

Organizations We've Built Together

ACHEM
Association for Cannabis Health Equity & Medicine

Serving the needs healers and medical professionals in the advancement of health equity.

www.achemed.org

Allyance
Creating Entourage Benefit.
Boosting ASTEAMM™

www.chemallyance.org

Join the movement.

MEET THE SPONSORS

We salute our generous supporters for making it possible us to explore new cannabis research frontiers.

Visit each sponsor exhibit booth. Click this link to begin your exploration.
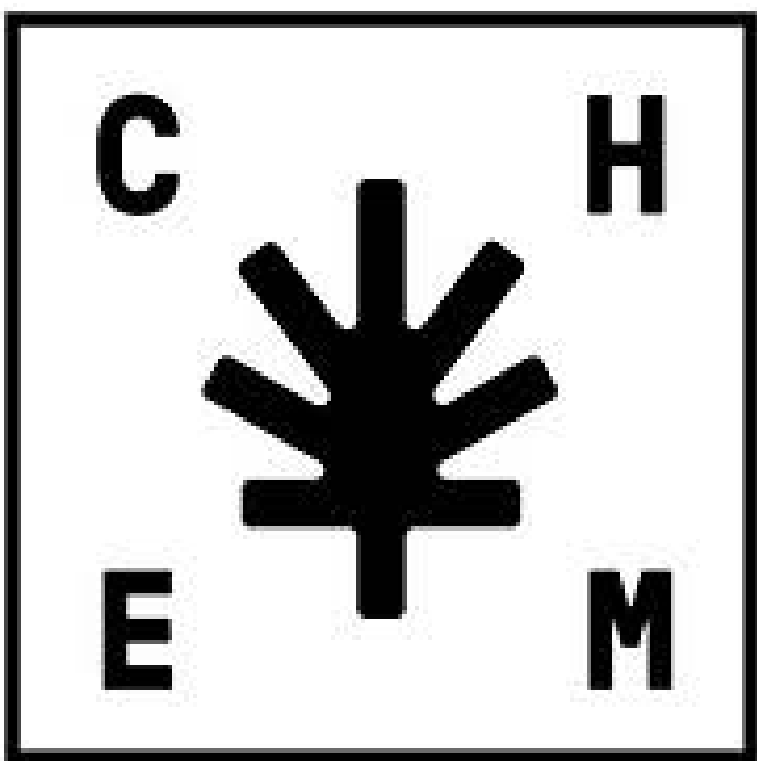
VISIT THE
VIRTUAL
POSTER HALL

VIRTUAL POSTER HALL

TWENTY+ RESEARCH POSTERS

MONDAY, AUGUST 8 | 12:30 PM - 1:15 PM
TUESDAY, AUGUST 9 | 12:30 PM - 1:15 PM
WEDNESDAY, AUGUST 10 | 12:20 PM - 1:20 PM

THE RESEARCH PROGRAM COMMITTEE

The 2022 Virtual Cannabis Research Conference's Research Program Committee is comprised of educators, scientists, chemists, and researchers from a variety of disciplines from some of the nation's leading cannabis research institutions.

Craig Marcus, PhD
Professor
Oregon State University

Dasheeda Dawson, MBA

Rachel Knox, MD
Board Chair
CHEM Allyance

Mark Berhow, PhD
Research Chemist
USDA ARS NCAUR Peoria

Massimo Bionaz, PhD
Associate Professor
Oregon State University

Nurys Camargo, JD
Massachusetts Cannabis Commissioner

Chris Delhom, PhD
Mechanical Engineer
USDA ARS
New Orleans, LA

Jennifer Duringer, PhD
Assistant Professor
Oregon State University

David Gang, PhD
Professor
Washington State University

THE RESEARCH PROGRAM COMMITTEE

These professionals are passionate and dedicated to advancing cannabis research.

We salute our program committee members for making the 2022 Virtual Cannabis Research Conference an innovative way to explore new cannabis research frontiers.

Justin Goss, PhD
Professor
Colorado State University Pueblo

Kimberly Guay, PhD
Professor
Tarleton State University

Nebojsa Jaksic, PhD
Professor
Colorado State University Pueblo

Kathy Jensen, MS
President
Catena International

Ronald Kander, PhD
Associate Professor
Thomas Jefferson University

Raj Kasula, PhD
Senior Vice President
Wenger Group

Eun Soo Kim, PhD
Visiting Scientist
Colorado State University Pueblo

David Kroll, PhD
Professor
University of Colorado

Xianyan Kuang, PhD
Research Assistant Professor
Alabama A&M University

THE RESEARCH PROGRAM COMMITTEE

We salute our program committee members for making the 2022 Virtual Cannabis Research Conference an innovative way to explore new cannabis research frontiers.

Emily Lindley, PhD
Assistant Professor
University of Colorado

Tyler Mark, PhD
Assistant Professor
University of Kentucky
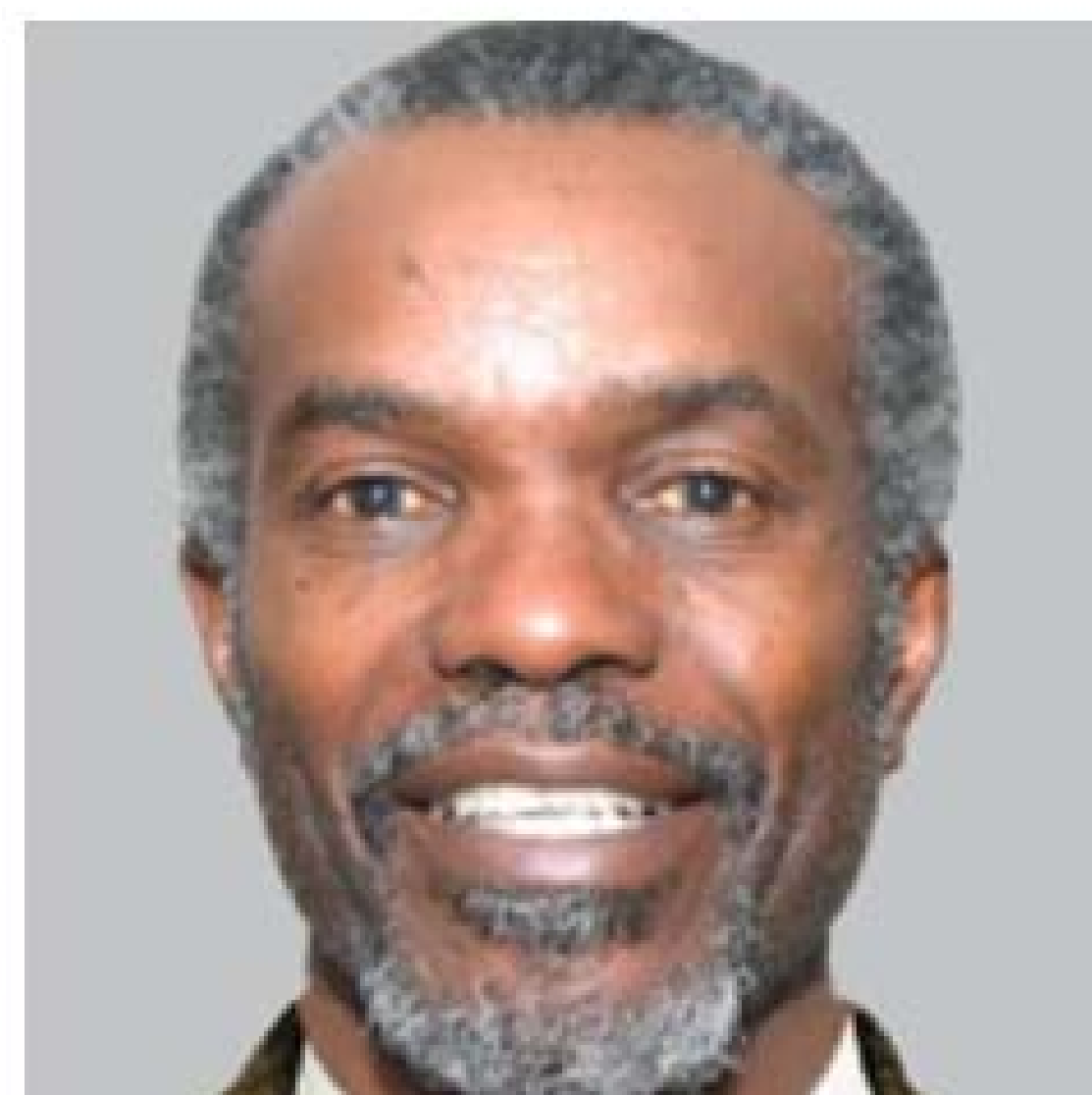
Desmond Mortley, PhD
Research Professor of Plant and Soil Science
Tuskegee University
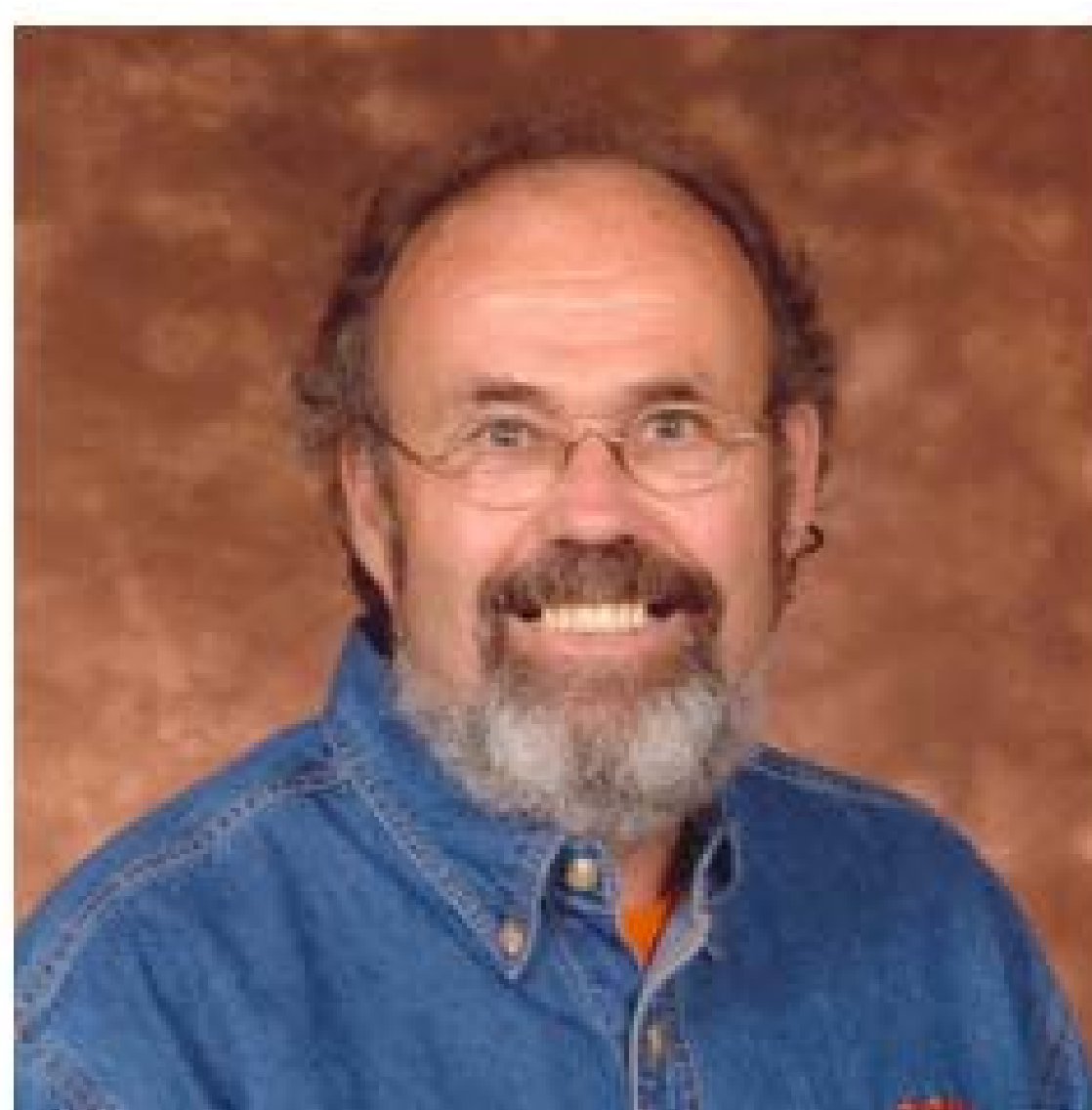
Skip Rochefort, PhD
Professor
Oregon State University

Sang-Hyuck Park, PhD
Senior Scientist
Colorado State University Pueblo

Ernie Cebert, PhD
Assistant Professor
Alabama A&M University

Linda Schutjer, JD
Senior Legal Counsel
Colorado State University

Clark Seavert, PhD
Professor
Oregon State University

Naresh Shahi, PhD
Tuskegee University

THE RESEARCH PROGRAM COMMITTEE

John Simonsen, PhD
Professor
Oregon State University

Jordan Tishler, MD
Instructor
Harvard Medical School

Kelly Vining, PhD
Associate Professor
Oregon State University

Beau Whitney, MBA
Chief Economist
Whitney Economics

Richard Van Breemen, PhD
Professor
Oregon State Universtiy

THE MECHOULAM LECTURE

Endocannabinoid/Serotonin Interactions
in the Regulation of Nausea

Monday, August 8th
8:50 am - 9:50 am PST

Nausea and vomiting are symptoms that continue to be problematic for cancer patients undergoing chemotherapy treatment, despite the use of the recommended anti-emetic treatments. Although high quality human clinical trial data is very limited, pre-clinical evidence suggests that cannabinoids and manipulations of the endocannabinoid system, as well as other fatty acid amides have anti-nausea/anti-emetic potential. Indeed, several studies reveal the potential of ineffective doses of cannabinoids to boost the anti-nausea effectiveness of both traditional and non-traditional anti-nausea treatments. The preclinical evidence highlights the need for further evaluation of cannabinoids and manipulations of endocannabinoids and other fatty acid amides in clinical trials.

Linda A Parker, PhD is the author of Cannabinoids and the Brain (MIT Press, 2017) and, along with Raphael Mechoulam and Erin Rock, CBD: What the Science Says (MIT Press, 2022). She is currently University Professor Emeritus at the University of Guelph, Ontario, Canada, where she held a Tier 1 Canada Research Chair (until July 1, 2020) in Behavioral Neuroscience.

She has over 200 publication most recently focused upon understanding the functioning of the endocannabinoid system and how plant derived cannabinoids act in the brain. She is past-PresideShe was awarded the Lifetime Achievement Award from the International Cannabinoid Research Society (2017) and the Medal of Merit from the University of Guelph (2022) for her contributions toward understanding the role of the endocannabinoid system in the regulation of nausea.

THE PLENARY LECTURE

The Untold History of Cannabis:
A Prerequisite To Defining Equity for an Industry

Tuesday, August 9th
8:50 am - 9:50 am PST

The history of cannabis in the United States tells of the plant's deep roots within colonial slavery, roots that cultivated the wealth of a nation as the plant traversed dueling planes of industrial, medical, and political interests. This presentation will confront a difficult truth—how cannabis has been abused - directly and indirectly - as a tool of oppression and suppression resulting in the divestment of marginalized communities of equitable access to wellbeing—but will conclude with an exploration of reconciliation to define what health equity must mean for cannabis industries, academia and research, medical care, and public policy today as we envision all that cannabis can do to advance sustainable development in the US and abroad.

Rachel Knox, MD, MBA is an endocannabinologist specializing in cannabinoid medicine, and is a thought leader and policy expert in cannabis and psychedelics health equity. She received her medical and business degrees from Tufts School of Medicine after completing her undergraduate studies at Duke, training in family and integrative medicine before pursuing additional study in the areas of functional medicine, cannabinology, and endocannabinology.

She is the creator, co-founder, and president of the Cannabis Health Equity Movement (CHEM)™, chairing the movement's non-profit organizations: the Association for Cannabis Health Equity and Medicine (ACHEM) and CHEM Allyance. From CHEM to her work in cannabis and psychedelics policy and regulation, Dr. Rachel centers advocacy around the roles cannabis, psychedelics, and other earth resources can play in addressing the Minority Health Disparity Gap as applied to the CHEM Pillars of Health Equity™, a rubric she developed to drive competency around equity, measure access to wellbeing, and appraise the impact of social and economic effort in the pursuit of ensuring access to full health and wellbeing for all people.
READ MORE

THE PROGRAM

DAILY AGENDA (TIME ZONE: PT)

Monday, August 8, 2022

Time				
8:30 AM - 8:50 AM	WELCOME & OPENING REMARKS			
8:50 AM - 9:50 AM	MECHOULAM PLEANARY LECTURE presented by DR. LINDA PARKER			

CONCURRENT SESSIONS

Time		EDUCATION SESSION 1 CHAIR: KATHY JENSEN MS, RDN		POLICY AND LEGAL LANDSCAPE SESSION 1 CHAIR: DR. LINDA SCHUTJER
9:50 AM - 10:20 AM	#6	A "CRITICAL CANNABIS STUDIES" SYLLABUS: AN EDUCATIONAL APPROACH TOWARDS CREATING EQUITABLE CANNABIS FUTURES	#85 (CHEM)	BIGGER IS NOT BETTER: PREVENTING MONOPOLIES IN THE NATIONAL CANNABIS MARKET
10:20 AM - 10:50 AM	#8A	THE CANNABIS EDUCATION LADDER AT THE UNIVERSITY OF COLORADO SKAGGS SCHOOL OF PHARMACY AND PHARMACEUTICAL SCIENCES	#87	CANNABIS RESEARCH AT THE NATIONAL INSTITUTE ON DRUG ABUSE
10:50 AM - 11:20 AM	#8B	CREATING MARKET STABILITY FROM A FOUNDATION OF EDUCATION	#89	NEW MARKETS FOR U.S. INDUSTRIAL HEMP THROUGH ANALYSIS OF ON-GOING EUROPEAN FOOD SAFETY AUTHORITY RISK ASSESSMENTS OF VALIDATED NOVEL FOOD APPLICATIONS
11:20 AM - 11:50 AM	#8C	GENERATING RESULTS THROUGH PERFORMANCE-BASED LEARNING IN THE CANNABIS INDUSTRY		LUNCH BREAK
11:50 AM -12:30 PM		LUNCH BREAK		
12:30 PM-1:15 PM	POSTER SESSION 1			

CONCURRENT SESSIONS

Time		GENETICS, GROWTH, AND CULTURE SESSION 1 CHAIR: DR.SANG-HYUCK PARK		MATERIALS, PROCESSING, AND PRODUCT MANUFACTURING SESSION 1 CHAIR: DR. NEB JAKSIC
1:15 PM - 1:40 PM	#14	DISEASE RISKS ASSOCIATED WITH HEMP PRODUCTION IN THE PACIFIC NORTHWEST	#79	ADAPTIVE CONTROLLER DESIGN FOR HEMP-BASED PAPER ROLL-TO-ROLL (R2R) MANUFACTURING
1:40 PM - 2:05 PM	#17	EVAPOTRANSPIRATION CRITERIA FOR IRRIGATION OF HEMP GROWN FOR CANNABINOIDS	#80	ASSESSMENT OF A HEMP-BY-PRODUCT FOR POTENTIAL APPLICATION AS A FUNCTIONAL FOOD INGREDIENT
2:05 PM - 2:30 PM	#23	IMPACT OF IBA CONCENTRATION AND FORMULATION AND PROPAGATION ENVIRONMENT ON ROOTING SUCCESS OF 'I3' HEMP BY STEM CUTTINGS	#81	INDUSTRIAL HEMP-DERIVED CELLULOSE-BASED MULTIFUNCTIONAL COMPOSITES: A SUSTAINABLE MATERIAL FOR BIOPLASTIC PRODUCTION
2:30 PM - 2:55 PM	#27	TERPENE SYNTHASE CHARACTERIZATION IN TWO CULTIVARS ON SHIMADZU TQ-8040 GAS CHROMATOGRAPHY WITH SELECTIVE ION MONITORING	#83	OPTIMIZATION OF SUPERCRITICAL FLUID EXTRACTION OF CANNABIDIOL FROM CHERRY BLOSSOM HEMP STRAIN
2:55 PM -3:20 PM	#29	ULTRASTRUCTURE OF HEMP SEED	#84	PROPERTIES OF MILLED HIGH-CANNABINOID HEMP STALK RESIDUES AND POTENTIAL FOR VALUE-ADDED APPLICATIONS

CONCURRENT SESSIONS

Time		HUMAN HEALTH AND MEDICINE SESSION 1 CHAIR: DR. RICHARD VAN BREEMEN		LIVESTOCK AND COMPANION ANIMALS/PETS SESSION 1 CHAIR: DR. MASSIMO BIONAZ
3:20 PM - 3:50 PM	#32 CHEM	CANNABIS SCIENCE: THE FOUNDATION OF BUDDING HEMP AND CANNABIS INDUSTRIES	#73	EFFECTS OF INDUSTRIAL HEMP (CANNABIS SATIVA) SUPPLEMENTATION ON BEHAVIOR OF ANGUS CATTLE
3:50 PM - 4:20 PM	#41	CANNABINOID HYPEREMESIS SYNDROME: IDENTIFICATION AND SURVEILLANCE	#74	PALATABILITY OF HEMPSEED MEAL PELLETS COMPARED TO MAINSTREAM FEEDSTUFFS IN HORSES
4:20 PM - 4:50 PM	#53	FETAL CANNABIDIOL (CBD) EXPOSURE AFFECTS HYPOTHALAMUS DEVELOPMENT AND GLUCOSE TOLERANCE	#75	SHORT TERM FEEDING OF INDUSTRIAL HEMP: PLASMA CANNABINOID CONCENTRATIONS, BEHAVIOR OUTCOMES, AND IMMUNE MODULATION IN HOLSTEIN STEERS
4:50 PM - 5:20 PM	#58	PRELIMINARY DATA COMPARING THE EFFICACY OF ACUTE VAPORIZED CANNABIS TO ORAL OXYCODONE AND PLACEBO FOR CHRONIC SPINE PAIN	#77	THE PRESENCE OF CANNABINOID RECEPTORS IN THE BOVINE OVARY

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IDENTIFICATION

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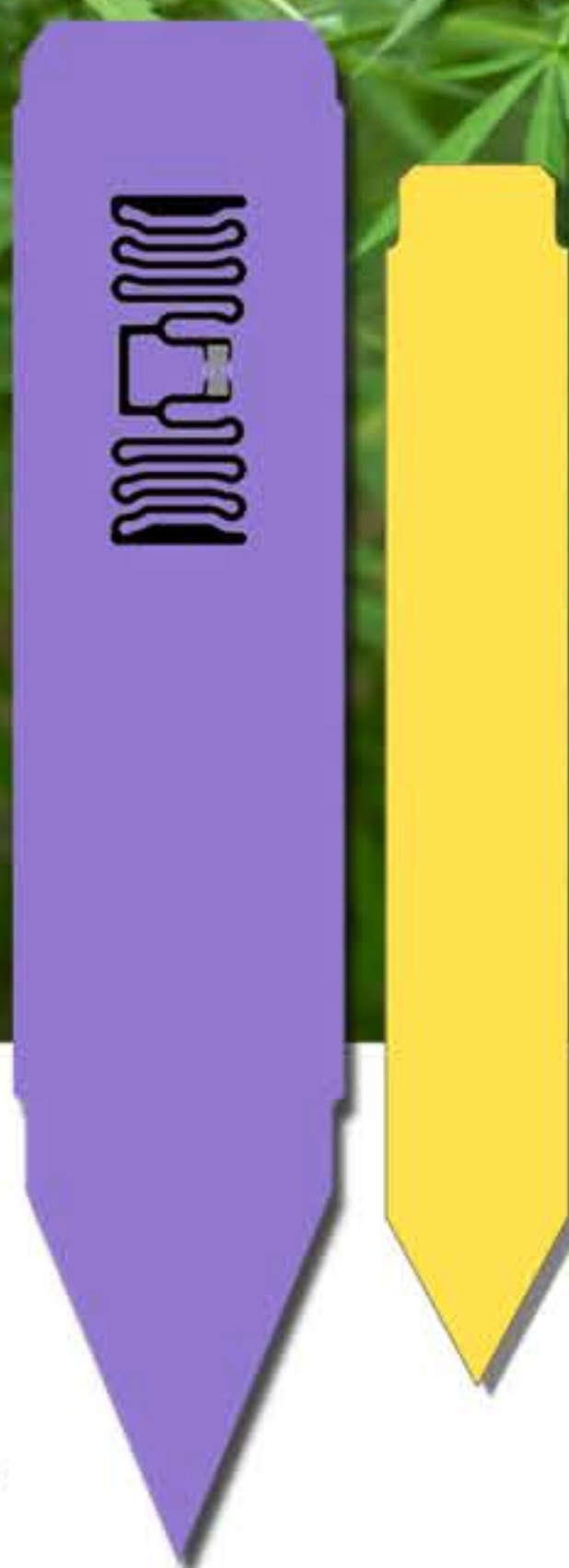
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DAILY AGENDA (TIME ZONE: PT)

		Tuesday, August 9, 2022		
8:30 AM - 4:00 PM		VIRTUAL LOUNGE & VIRTUAL EXHIBIT HALL OPEN		
8:30 AM - 8:50 AM		WELCOME AND COMMENTS		
8:50 AM - AM 9:50 AM		PLENARY LECTURE - DR. RACHEL KNOX		
		CONCURRENT SESSIONS		
		BUSINESS SESSION 1	QUALITY CONTROL SESSION 1	
		CHAIR: DR. CLARK SEAVERT	CHAIR: DR. DAVID GANG	
9:50 AM - 10:20 AM	#1 CHEM	LEVERAGING ESG FRAMEWORK TO BUILD STABLE PUBLIC-PRIVATE PARTNERSHIPS FOR COMMUNITY ACCESS & EQUITY IN THE CANNABIS INDUSTRY	#92	ASSESSMENT OF HEMP (CANNABIS SATIVA L.) CULTIVARS FOR ANTIOXIDANT CONTENT AND ANTINUTRIENT FACTORS
10:20 AM - 10:50 AM	#4	EXPLORING BRAND LOYALTY AND SALIENCE OF PURCHASING ATTRIBUTES AMONG CANNABIS BRANDS AND CONSUMERS	#95	EVALUATION OF METHODS USED TO SAMPLE HEMP FOR REGULATORY COMPLIANCE TESTING
10:50 AM - 11:20 AM	#5	HEMP COVER CROPPING FOR DRYLAND WHEAT FARMERS: OPPORTUNITIES FOR DISEASE SUPPRESSION AND INCREASED YIELD	#100	SIMPLIFYING COLORADO'S HEMP PESTICIDE TESTING WORKFLOW REQUIREMENTS WITH FULL LABORATORY AUTOMATION
11:20 AM - 12:30 PM		LUNCH BREAK		
12:30 PM - 1:15 PM		POSTER SESSION 2		
		CONCURRENT SESSIONS		
		EDUCATION SESSION 2	POLICY AND LEGAL LANDSCAPE SESSION 2	
		CHAIR: DR. DAVID KROLL	CHAIR: DASHEEDA DAWSON	
1:15 PM - 1:40 PM	#9	CANNABIS PROGRAMS AT THE COMMUNITY COLLEGE OF DENVER: INDUSTRY IN THE DRIVER'S SEAT.	#86 CHEM	MAKING IMPACT: SMART APPROACHES TO GOVERNMENT ACCOUNTABILITY IN REPAIRING THE WAR ON DRUGS
1:40 PM - 2:05 PM	#8F	THE HIGHS & LOWS OF MEDICAL CANNABIS: WHAT MEDICAL STUDENTS, TRAINEES AND OTHER ALLIED HEALTH CARE PROFESSIONALS NEED TO KNOW BUT DON'T.	PANEL DISCUSSION	MAKING IMPACT: SMART APPROACHES TO GOVERNMENT ACCOUNTABILITY IN REPAIRING THE WAR ON DRUGS
2:05 PM - 2:30 PM	#8G	CANNABINOID MEDICINE EDUCATION IN LATIN AMERICA : CHALLENGES AND OPPORTUNITIES	#102	HEMP LAW UPDATE -- 2022
2:30 PM - 2:55 PM	#103	THE INTERSECTION BETWEEN EDUCATION AND WELLNESS IN CANNABIS CULTURE.	POLICY AND LEGAL LANDSCAPE SESSION #2 PANEL DISSCUSSION	
2:55 PM -3:20 PM	PANEL DISCUSSION	EDUCATION SESSION #2 PANEL DISCUSSION		
		CONCURRENT SESSIONS		
		GENETICS, GROWTH, AND CULTURE SESSION 2	HUMAN HEALTH AND MEDICINE SESSION 2	
		CHAIR: DR.DESMOND MORTLEY	CHAIR: DR. EMILY LINDLEY	
3:20 PM-3:45 PM	#13	CHARACTERIZATION OF SOIL BACTERIA FROM CANNABIS SATIVA L. AND ITS EFFECTS ON SEED GERMINATION	#38	CANNABIDIOL AND THE CORTICORAPHE CIRCUIT IN POST-TRAUMATIC STRESS DISORDER
3:45 PM -4:10 PM	#15	EVALUATING NEW BIOSTIMULANTS IN CANNABIS PRODUCTION: A CASE STUDY WITH PINK PIGMENTED FACULTATIVE METHYLOTROPHS (PPFMS)	#40	CANNABIDIOL FOR THE TREATMENT OF IRRITABILITY AND AGGRESSION IN CHILDREN WITH AUTISM SPECTRUM DISORDER (CASCADE STUDY): SUMMARY OF 25 PARTICIPANT'S FUNCTIONAL ANALYSES OF PROBLEM BEHAVIOR
4:10 PM-4:35 PM	#16	EVALUATION OF ESSENTIAL OIL HEMP VARIETIES IN NORTHERN ALABAMA	#63	THE EFFECT OF FETAL CANNABIDIOL (CBD) EXPOSURE ON BRAIN DEVELOPMENT AND POSTNATAL BEHAVIOR
4:35 PM- 5:00 PM	#25	MIDWESTERN HEMP DATABASE: A INTERACTIVE DECISION MAKING TOOL FOR EVALUATING PERFORMANCE OF HIGH CANNABINOID HEMP CULTIVARS	HUMAN HEALTH AND MEDICINE SESSION 2 - PANEL DISCUSSION	
5:00 PM -5:25 PM	PANEL DISCUSSION	GENETIC, GROWTH, AND CULTURE SESSION #2 PANEL DISCUSSION		

Cannabis production

plantlogic

5L 7L 25L 30L

Drainage collection pots

The Plantlogic DC pots direct water flow into a narrow gutter which channels drainage out of the growing area, reducing humidity and encouraging oxygen uptake.

Air flow

Non-draining side holes allow **oxygen uptake** in center of root mass, and prevents growing down.
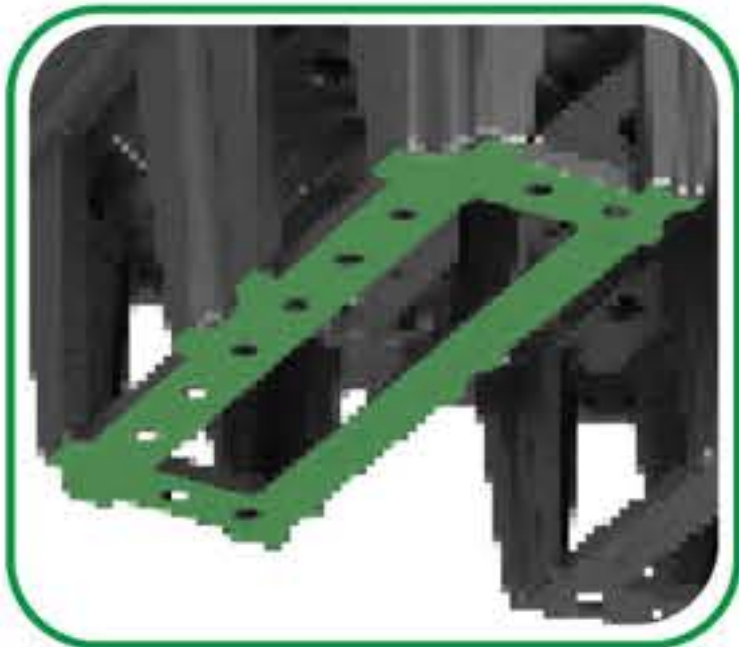
Wide feet

Promote stability even on soft ground.

Tall legs

Prevent root contact with soil and pathogens.

Easy maintenance with 100% drainage

Excellent drainage

Our unique base design forces water to drain from the center holes, minimizing the wet zone.

DAILY AGENDA (TIME ZONE: PT)

Time (PT)	Wednesday, August 10			
8:45 AM - 9:00 AM	WELCOME AND COMMENTS			
	CONCURRENT SESSIONS			
	HUMAN HEALTH AND MEDICINE SESSION 3		LIVESTOCK AND COMPANION ANIMALS/PETS SESSION 2	
	CHAIR: KATHY JENSEN, MS, RDN		CHAIR: DR. KIMBERLY GUAY	
9:00 AM - 9:25 AM	#33 CHEM	CHEM PILLARS OF HEALTH EQUITY: A UNIVERSAL RUBRIC FOR ACHIEVING EQUITY IN AND BY WAY OF THE CANNABIS INDUSTRY AND BEYOND.	#68	ACCEPTABILITY OF HEMPSEED MEAL IN HORSES
9:25 AM-10:15 AM	PANEL DISCUSSION	CHEM PILLARS OF HEALTH EQUITY: A UNIVERSAL RUBRIC FOR ACHIEVING EQUITY IN AND BY WAY OF THE CANNABIS INDUSTRY AND BEYOND.	#71	BEHAVIORAL RESPONSES OF CATTLE FED INDUSTRIAL HEMP
10:15 - 10:40 AM			#72	EFFECTS OF FEEDING INDUSTRIAL HEMP (CANNABIS SATIVA) ON CHUTE BEHAVIOR, HEMOGRAM AND SERUM CHEMISTRY OF WEANED BEEF CALVES
10:40 AM - 11:05 AM	#43	CANNABINOIDS AND INHIBITION OF SARS-COV-2 REPLICATION	#76	THE EFFECT OF HEMP (CANNABIS SATIVA) SUPPLEMENTATION TO THE SKIP-A-DAY FEEDING METHOD IN BROILER CHICKENS ON ANIMAL BEHAVIOR AND ANIMAL PERFORMANCE.
11:05 AM - 11:55 AM	#36	BUILDING A MORE EFFECTIVE MEDICAL CANNABIS SYSTEM	#78	TRANSFER OF CANNABINOIDS COMPOUNDS FROM SPENT HEMP BIOMASS FED TO LAMBS IN ADIPOSE TISSUE AND MUSCLE
11:55 AM - 12:20 PM	#42	CANNABINOID THERAPIES SAFETY AND ADVERSE EVENTS	PANEL DISCUSSION	LIVESTOCK AND COMPANION ANIMALS/PETS SESSION #2 PANEL DISCUSSION
11:55 AM - 12:20 PM	LUNCH BREAK			
12:20 PM -1:20 PM	POSTER SESSION 3			
	CONCURRENT SESSIONS			
	BUSINESS SESSION 2		QUALITY CONTROL SESSION 2	
	CHAIR: DR. BEAU WHITNEY		CHAIR: DR. JENNIFER DURINGER	
1:20 PM - 1:45 PM	#2 CHEM	CHEM GLOBAL CAMPUS: BOOSTING ASTEAMM™ AND LONG-TERM SUSTAINABILITY WITH HEMP	#93	ASSIGNING TARGET VALUES FOR UP TO 17 CANNABINOIDS IN CANNABIS PLANT AND OIL SAMPLES FOR USE IN THE NIST CANNABIS QUALITY ASSURANCE PROGRAM (CANNAQAP)
1:45 PM-2:10 PM	PANEL DISCUSSION	CHEM GLOBAL CAMPUS: BOOSTING ASTEAMM™ AND LONG-TERM SUSTAINABILITY WITH HEMP	#94	EFFECT OF FERTILIZERS AND HARVEST TIME ON THE DEVELOPMENT OF CANNABINOIDS IN INDUSTRIAL HEMP
2:10 PM -2:35 PM			#97	GC-MS TERPENE ANALYSIS THROUGHOUT DRYING PROCESSES OF CHARLOTTE'S WEB PATENTED HEMP CULTIVARS CW1AS1, KIRSCHE, AND LINDOREA
2:35 PM -3:00 PM			#99	NUTRITIONAL AND POTENCY CHARACTERIZATION OF HEMP AS A POSSIBLE FEED SOURCE FOR LIVESTOCK
3:00 PM -3:25 PM			PANEL DISCUSSION	QUALITY CONTROL SESSION #2 PANEL DISCUSSION
3:25 PM-3:50 PM	CLOSING REMARKS - ANNOUNCMENT OF NEXT YEARS MEETING			

JOIN US!

2023

CANNABIS RESEARCH CONFERENCE
DENVER, COLORADO

POSTER SESSSION 1 MONDAY, AUGUST 8 12:30 PM - 1:15 PM	POSTER #	TITLE
4	101	TARGETED AND NON-TARGETED HIGH-RESOLUTION LCMS LIPIDOMIC ANALYSIS OF FAT SAMPLES FROM LAMBS FED WITH SPENT HEMP BIOMASS
6	69	ANALYSIS OF CANNABINOIDS IN MILK FROM COWS CONSUMING SPENT HEMP BIOMASS USING ULTRA HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY-TANDEM MASS SPECTROMETRY
8	49	DETERMINATION OF RETTED HEMP MICROBIOTA USING CULTURE- DEPENDENT AND DNA SEQUENCING METHOD

POSTER SESSIONS - DAILY AGENDA (TIME ZONE: PT)
TUESDAY, AUGUST 9

POSTER SESSSION 2 TUESDAY, AUGUST 9 12:30 PM - 1:15 PM	POSTER #	TITLE
10	10	SURVEY OF INSECT PEST COMPLEX IN SOUTHERN OREGON OUTDOOR HEMP FIELDS
12	12	ALTERNATIVE WEED MANAGEMENT STRATEGIES FOR RESINOUS HEMP PRODUCTION
13	18	FLORAL HEMP PERFORMANCE UNDER DIFFERENTIAL IRRIGATION IN FIELD PLASTICULTURE
14	19	GENETIC BASIS FOR PRODUCTION OF THCV, A RARE AND POTENTIALLY MEDICALLY VALUABLE CANNABINOID
16	21	HOPPS LATENT VIROID (HPLVD) IS STABLE OUTSIDE OF CANNABIS PLANT & CAN INFECT THROUGH WATER
17	22	IDENTIFYING CBGA GENES IN CANNABIS SATIVA
18	24	IN PLANTA FEMALE FLOWER AGROINFILTRATION ALTERS THE CANNABINOID COMPOSITION IN INDUSTRIAL HEMP (CANNABIS SATIVA L.)
19	26	PREVALENCE OF FUSARIUM SPECIES ASSOCIATED WITH HEMP SEED
20	28	THE FEASIBILITY OF GROWING HEMP FOR FIBER IN COLORADO
21	30	WEEKLY TISSUE AND SOIL TESTING CRITERIA TO MEET THE NUTRIENT NEEDS OF HEMP GROWN FOR CANNABINOIDS

POSTER SESSSION 3 WEDNESDAY, AUGUST 10 12:20 PM - 1:20 PM	POSTER #	TITLE
22	31	A NETWORK PHARMACOLOGY-BASED STUDY ON THE MOLECULAR MECHANISMS OF THE ACTIVE INGREDIENTS OF CANNABIS SATIVA L. AGAINST MULTIDRUG RESISTANCE IN CERVICAL CANCER
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ORAL & PANEL ABSTRACTS
Monday, August 8

9:50 AM - 10:20 AM

POLICY AND LEGAL LANDSCAPE SESSION 1 - ORAL/PLATFORM

BIGGER IS NOT BETTER: PREVENTING MONOPOLIES IN THE NATIONAL CANNABIS MARKET

Presenter Shaleen Title, JD

It is a crucial and vulnerable moment for the future of the cannabis market. While states are making historic progress creating paths for small businesses and disenfranchised groups, larger companies are expanding, consolidating, and lobbying for licensing rules to create or maintain oligopolies. Federal legalization will only accelerate the power grab already happening with new, larger conglomerates openly expressing interest. Left unchecked, this scramble for market share threatens to undermine public health and safety and undo bold state-level efforts to build an equitable cannabis marketplace. This paper argues for intentionally applying well-developed antitrust principles to federal cannabis reform now, before monopolization of the market takes place, and offers eight concrete policy recommendations.

EDUCATION SESSION 1 - ORAL/PLATFORM A

CRITICAL CANNABIS STUDIES" SYLLABUS: AN EDUCATIONAL APPROACH TOWARDS CREATING EQUITABLE CANNABIS FUTURES

Presenter Magaly Ordonez

Background: historically, there has been a long trajectory of cannabis miseducation across the U.S. Shaped by racial prejudice. The purpose of this study is to provide a syllabus, or curricular pathway, in which a critical and conscious education can positively impact the ways society learns about cannabis.

Methods: using archival and ethnographic methodological approaches, this study looks into historical documents, visual media, law and policy reviews, maps, interview data, and participant observations to develop an inclusive critical cannabis studies curriculum. This interdisciplinary project maps out a syllabus that, while capacious in its goals, prioritizes the voices and histories of black, indigenous, latinx, and underrepresented communities, folks who have been left out of the legal cannabis community including formerly incarcerated people. This study builds from a qualitative dissertation study on cannabis relationships and spaces in los angeles as a starting point to thinking about what cannabis education can represent for the growing cannabis industry and culture across the U.S.

Results and discussion: the results from this syllabus demonstrate the importance for folks who use, consume, or engage with cannabis to have reliable and holistic cannabis information given the rapid shift in cannabis legislation across the U.S. And globally. A few topics that are prioritized in this critical cannabis studies syllabus/curriculum are: cannabis biology and chemistry, cannabis politics and consequences of prohibition, era of counterculture, and social equity & cannabis futures.

Conclusions: this study offers an educational approach towards creating equitable cannabis futures that explores new cannabis research endeavors and still honors the people who made possible our current access to legal cannabis. The potential implications of this research is its importance to the cannabis industry's social impact, public health regulations, legal and policy reforms, and also university departments interested in developing a cannabis studies program or concentration. While this syllabus is shaped by an I.A. Cannabis culture, this syllabus can be accommodated to the relevancy of a particular city and/or state. The future of cannabis needs to be social justice oriented with equitable practices, policies, and relationship that mutually benefit everyone involved.

10:20 AM - 10:50 AM

EDUCATION SESSION 1 - PANEL DISCUSSION

THE CANNABIS EDUCATION LADDER AT THE UNIVERSITY OF COLORADO SKAGGS SCHOOL OF PHARMACY AND PHARMACEUTICAL SCIENCES

Presenter David Kroll, MD

Background: Recent studies suggest that health care practitioners feel underprepared to discuss cannabis use and risks with their patients, particularly with regard to drug-cannabis interactions and specific product quality and safety. There is, thus, an emerging recognition of the importance that health care practitioners know about the uses of cannabis. However, there is an absence of reliable, accessible information to address this knowledge deficit. Methods: The University of Colorado Skaggs School of Pharmacy and Pharmaceutical Sciences launched a ladder of three, online educational programs in Cannabis Science and Medicine (CSM). The first of these is an 8-week, continuing education program comprised of recorded lectures and live, case discussions with program faculty. The second is the 9-credit CSM Graduate Certificate that builds upon the continuing education program to offer 135 hours of coursework and competency-building exercises. The third is the CSM specialty track in our existing, 30-credit Master of Science in Pharmaceutical Sciences program, comprised of core coursework in the pharmaceutical sciences and 15 credits of cannabis-specific coursework.

Results and Discussion: Over 190 health care professionals have completed one of five continuing education offerings, with pretest scores (mean + SD) of 57 ± 13, 53 ± 14, 51 ± 11, 51 ± 18, 55 ± 3.9 and post-test scores of 91 ± 7.6, 90 ± 7.0, 89 ± 9.3, 88 ± 7.9, 85 ± 2.2. The CSM Graduate Certificate has now graduated two classes, with 8 and 6 graduates in 2021 and 2022, respectively, with attrition of only one student in 2021. The CSM track of the MS in Pharmaceutical Sciences will graduate their first students in 2023, with 11 current students and 10 matriculating in Fall 2022.

Conclusion: Collectively, the three CSM programs have filled an important need for health professionals and cannabis scientists while maximizing faculty effort through curricular progression of increasing complexity.

ORAL & PANEL ABSTRACTS
Monday, August 8

10:20 AM - 10:50 AM

POLICY AND LEGAL LANDSCAPE SESSION 1 - ORAL/PLATFORM
CANNABIS RESEARCH AT THE NATIONAL INSTITUTE ON DRUG ABUSE
Presenter - Heather Kimmel

While cannabis is illegal under federal law, an increasing number of states in the united states have moved to decriminalize or legalize it in some form. Public opinion about cannabis use has become more permissive, while proliferating cannabis dispensaries for medical or recreational use are providing novel methods and formulations for consuming cannabis. For the past few years, we have been learning about both the short-term and long-term public health effects of these policy changes as well as their social and economic effects. These questions are the focus of intense public and scientific debate as state citizens consider and vote on medical and recreational cannabis laws and as clinicians and policy makers seek treatment and legislative guidance from scientific research findings. One of the research priorities of National Institute on Drug Abuse (nida) is to support the science addressing public health challenges like those posed by changes in state and local cannabis laws. NIDA-supported research aims to help inform decision-making related to these policies, both in reducing the burden of drug related negative outcomes and in continuing to explore the therapeutic potential of cannabis-derived compounds for pain and addiction. This presentation will provide an update on the findings from cannabis policy research currently underway at nida described at previous icr meetings, as well as information on available cannabis research opportunities in the context of overall nida priorities. We will also discuss nida's participation in trans-nih and interagency activities.

10:50 AM - 11:20 AM

POLICY AND LEGAL LANDSCAPE SESSION 1 - ORAL/PLATFORM
NEW MARKETS FOR U.S. INDUSTRIAL HEMP THROUGH ANALYSIS OF ON-GOING EUROPEAN FOOD SAFETY AUTHORITY RISK ASSESSMENTS OF VALIDATED NOVEL FOOD APPLICATIONS
Presenter Richard Clabaugh

The USDA`s final rule on hemp effective on March 22, 2021, was expected to bring about price stability in hemp biomass caused by initial misalignment in the number of hemp cultivators with producers and the lack of infrastructure and markets, which in 2019 left an estimated avg. of CA. 25,000 Pounds per farm unsold in the U.S. The final rule explicitly stated a ruling on hemp-derived delta-8 thc exceeds its mandate, whereby many States have thus either placed restrictions on it or forbid its sale entirely further precipitating the price collapse to near zero. Hemp seeds have been used as both human and livestock feed far prior, but also during, much of the 20th century within europe, and are not considered novel foods. In contrast, because the EFSA has found the CBD, the far more lucrative element found in hemp, was not consumed by humans in significant measure within the european community before May 15, 1997, it is novel. Although the EFSA continues to validate novel food applications for use of cbd in food, a costly and extensive risk assessment for each product inter alia must be conducted before each application may be approved for marketing as an foods ingredient or nutritional supplement, following the european commission restatement of the ecj decision in kanavape that CBD is not a narcotic and thus cannot be considered a "medicinal product."

This study examines the legality of industrial hemp biomass exports from the US to the EU, in particularly, hemp florescence and the cbd derived therefrom. Particular analysis is made of the requirements for validation of the novel foods applications and subsequent technical and safety review and toxicological reporting requirements to pass the risk assessments being conducted by the EFSA. Due to the lack of these regulatory hurdles, hemp-derived cbd-infused food and beverage producers are at an operative head start in the U.S. Versus their european competitors, who to date cannot yet market their intended products. The study concludes with an analysis of these first-to-market advantages in terms of the efsa application and risk assessment, and how they may potentially assist us hemp-derived CBD in finding new access to european markets.

EDUCATION SESSION 1 - ORAL/PLATFORM
CREATING MARKET STABILITY FROM A FOUNDATION OF EDUCATION
Presenter Robert Hoban

Creating market stability from a foundation of education:Robert Hoban, chair of Clark Hill Law's Cannabis Practice, and the leading legal mind in the global cannabis space, will explore and discuss the reasons why education and research remain critical to progressive legislation and policy making for cannabis operators around the world. Markets fail and succeed for a variety of reasons, one of which is information asymmetry – the concept that an inconsistent level of information across market stakeholders creates imbalance in the application, deployment and development of the goods or services that define the market. Information asymmetry regularly rears it's head in the cannabis space at the policy and regulatory level. Far too often, the stakeholders invested in developing, writing and deploying the rules and regulations that control business operations in the cannabis industry are not exposed to the cutting edge research that drives much of the business development in the space. As such, policy and regulations trail years behind leading business practices.

11:20 AM - 11:50 AM

EDUCATION SESSION 1 - ORAL/PLATFORM A
GENERATING RESULTS THROUGH PERFORMANCE-BASED LEARNING IN THE CANNABIS INDUSTRY
Presenter Howard Lewis

Education and training are essential to the success of individuals and organizations operating in this diverse and rapidly evolving industry. To maximize effectiveness, academic courses and job-specific training can focus on performance – that is, what people must be able to do to generate desired results.

In this session, we will examine:
- A focus on performance,
- A system perspective for individual performance,
- Mapping the learning journey,
- The performance learning system, and
- A blended approach to performance-based learning (rapid task analysis).

The best practice techniques that will be shared and discussed are well-grounded in research and extensive practice and can be applied immediately.

ORAL & PANEL ABSTRACTS
Monday, August 8

1:15 PM - 1:40 PM

GENETICS, GROWTH, AND CULTURE SESSION 1 - ORAL/PLATFORM

DISEASE RISKS ASSOCIATED WITH HEMP PRODUCTION IN THE PACIFIC NORTHWEST

Presenter Cynthia Ocamb | Hannah M. Rivedal, David H. Gent, Achala N. KC, Gordon B. Jones, Jeremiah K.s. Dung, Inga A. Zasada, Lester Nacuate, Rodriguez, William J. Thomas, Andrea R. Garfinkel, Briana J. Claassen, Michele S. Wiseman, Stephan T. Massie,

Cannabis sativa (hemp, marijuana) is an emerging crop, but due its relatively short legal existence as a cultivated plant in the us, little has been reported on disease pressure in the pacific northwest. During 2021, hemp plants in 32 fields in oregon and 11 in washington were examined for disease after transplanting and at mid- and late-season. Fields were located across oregon as well as in the yakima valley of central washington. For powdery mildew, ten leaves were examined on each plant in one or two 100-plant transects. For other diseases, plants were visually examined for symptoms and suspect diseases were recorded on a per field or per plant basis. Representative disease samples were returned to campus for diagnosis and pathogen identification. Pathogen identification was done by molecular testing of powdery mildew and virus/viroid-infected plant material. The other disease samples were diagnosed by morphological characteristics of microorganisms produced or isolated from infected tissues, and/or by molecular testing. Ten 12-inch soil cores per transect were collected late season, bulked by transect, and nematodes were extracted from transect subsamples.

Powdery mildew occurred in 38% of the fields in oregon and 9% in washington. Molecular characterization of powdery mildew fungi showed that golovinomyces ambrosiae occurred in all affected fields while podosphaera macularis co-occurred in several fields. Based on field observations, virus-like diseases were suspected in 75% of oregon and 100% of washington fields. Beet curly top virus was confirmed by pcr testing in 54% and 91% of oregon and washington fields, respectively. Hop latent viroid was detected at several sites. Bud rot was found in several oregon fields and none in washington; it was sometimes associated with caterpillar damage. Few leaf spots were observed, and appear to be associated with insect injury. Other diseases occurred infrequently. Plant-parasitic nematode populations were present at low levels in field soil samples; pratylenchus was the most common (58% of the samples) with an average of 42 nematodes/250g of soil. Results from this survey provide documentation of pathogens present during 2021 in hemp fields in the pacific northwest and guidance to help prioritize future research and management.

MATERIALS, PROCESSING, AND PRODUCT MANUFACTURING SESSION 1 - ORAL/PLATFORM

ADAPTIVE CONTROLLER DESIGN FOR HEMP-BASED PAPER ROLL-TO-ROLL (R2R) MANUFACTURING

Presenter Trung Duong

Background: hemp paper is a valuable alternative to conventional paper made from trees and could provide a more renewable source for much of the world's paper needs. Hemp is more suitable for paper as it has higher cellulose and lower lignin content. Hemp paper is also much eco-friendlier and more sustainable than tree paper, as hemp can be produced much quicker than trees. The purposes of this project are to investigate the characteristics of hemp-based papers in a roll-to-roll (r2r) process and to design adaptive control schemes for control of web tension in r2r manufacturing systems.

Methods: an adaptive control scheme is proposed, which is based on the model reference approach where the controller gains are estimated based on matching the actual closed-loop tension control systems with an appropriately chosen reference model. The first step is studying the mechanical properties of hemp-based papers under the influence of hemp particles and temperature and the differences between papers from wood and hemp cellulose pulps. Then different designs of adaptive control schemes are investigated to select the one that satisfies: simple for practicing engineers, easy to implement in real-time, and able to auto-tune. After the controller's structure is selected, the controller gains are estimated by matching the plant performance and desired characteristics provided by a reference model. The estimates of the controller parameters are initialized by considering the stability of the nominal closed-loop tension control system.

Results and discussion: model reference direct and indirect adaptive schemes for web tension control are investigated and implemented on an experimental platform. The experimental measurements are compared with results from the simulation of models from matlab/simulink to validate the reliability of the design.

Conclusions: an adaptive controller design for the hemp-based paper r2r manufacturing process using the model reference approach is proposed. The project promotes the adoption of industrial hemp products, facilitates the understanding of the difference between wood-based and hemp-based papers in the r2r processes, and proposes a suitable technology to reduce the overall production cost of hemp-based paper.

1:40 PM - 2:05 PM

GENETICS, GROWTH, AND CULTURE SESSION 1 - ORAL/PLATFORM A

EVAPOTRANSPIRATION CRITERIA FOR IRRIGATION OF HEMP GROWN FOR CANNABINOIDS

Presenter Clinton Shock | Orami Gips

Hemp (cannabis sativa) grown for cannabinoids is a relatively new specialty field crop. The hemp irrigation criteria to maximize hemp flower and cannabinoid yield is poorly defined. Hemp growth and yield responses to crop evapotranspiration criteria were studied at 5 locations in 2020 and at 6 locations in 2021 in cooperation with the osu global hemp innovation center. The results reported here are from ontario, oregon in 2020. Hemp was drip-irrigated at 100%, 80%, 60%, and 40% reference et factoring in anticipated coefficients for phenological stages of hemp development. The four irrigation treatments were randomized and replicated four times as the main plots. Four hemp cultivars were planted as split plots in the main plots. Two photoperiod-insensitive "autoflower" cultivars and two photoperiod-sensitive "full season" cultivars were planted. Hemp cultivars were in 4-row plots planted on 76-cm beds on 5 june on silt loam and thinned to 38,300 and 25,500 plants per hectare for the photoperiod insensitive and the photoperiod sensitive cultivars, respectively. Photoperiod sensitive cultivars reached full cover by 50 days after planting with only small differences in cover by irrigation criteria. The autoflower cultivars never exceeded 50 percent cover regardless of the irrigation criteria. The amounts of water applied to the autoflower cultivars were probably in excess and the cultivars had little response to irrigation criteria as measured in plant height, biomass yield, flower yield, cannabinoid content and cannabinoid yield. The photoperiod sensitive cultivars had highly significant positive responses to irrigation criteria in plant height, biomass yield, flower yield, flower cannabinoid content, and cannabinoid yield. Highest yields of the photoperiod sensitive cultivars exceeded 4,000 kg of flower and 500 kg of cannabinoids per hectare.

ORAL & PANEL ABSTRACTS
Monday, August 8

12:30 PM - 1:15 PM
MATERIALS, PROCESSING, AND PRODUCT MANUFACTURING SESSION 1 - ORAL/PLATFORM
ASSESSMENT OF A HEMP-BY-PRODUCT FOR POTENTIAL APPLICATION AS A FUNCTIONAL FOOD INGREDIENT
Presenter - Elvis Baidoo | Ernst Cebert, Martha Verghese, joshua Herring

Background:
the recent growth of the hemp industry comes with challenges in agricultural waste management. Cannabidiol (cbd) oil extraction from hemp buds and seeds generates by-product biomass (hemp flakes). This work is based on the hypothesis that hemp flakes contain residual nutritional and health value which would add value to the food industry. The objective of this work was to compare hemp flakes to commercial hemp products to assess its potential as a food ingredient.

Methods
the chemical composition, antioxidant properties, and heavy metal content (al, cu, as, pb, co, and cd) were compared to three commercial hemp products. Antioxidant properties studied were total phenolic compounds, total flavonoids, ferric reducing antioxidant power, 2,2-diphenyl-1-picrylhydrazyl free radical scavenging method (dpph), and trolox equivalent antioxidant capacity (teac).

Results and discussion
results showed that the protein, fiber, and fat content of the hemp flakes compared well with the commercial products, showing intermediate levels among tested samples. The protein contents were significantly different ($p <= 0.05$) Among the samples, with the hemp flakes exhibiting competitive levels among the samples. There were no significant differences in flavonoid and total polyphenols in all hemp samples but were significantly different using different solvents for extraction. Heavy metal levels of all tested products were within the permissible limits according to fda and epa standards, however, while more hazardous metals such as arsenic and lead were not detected in all, aluminum and copper were present in all hemp samples studied. Negative correlations ($r = -0.951$, $P <= 0.000$ And $r = -0.724$, $P <= 0.008$) Were found between protein and aluminum and copper respectively, and a positive correlation ($r = 0.642$, $P <= 0.025$) Between ash and protein, suggesting that chemical composition might be used an indicator of heavy metal accumulation in hemp.

Conclusion
overall, the results suggest that hemp flake is safe to be applied as food as an ingredient, considering its high antioxidant potential and safe heavy metal levels. It could be used to complement other ingredients for food processing, to benefit from its nutritional and health rewards.

2:05 PM - 2:30 PM
MATERIALS, PROCESSING, AND PRODUCT MANUFACTURING SESSION 1 - ORAL/PLATFORM
INDUSTRIAL HEMP-DERIVED CELLULOSE-BASED MULTIFUNCTIONAL COMPOSITES: A SUSTAINABLE MATERIAL FOR BIOPLASTIC PRODUCTION
Presenter - Naresh Shahi, Desmond Mortley

Comprehensive utilization of hemp residues has attracted increasing attention due to the promotion of sustainability and circular economy in the hemp industry. In this study, cellulose was extracted from industrial hemp (cv. Henola) hurd grown at tuskegee university using alkaline hydrogen peroxide. Isolated cellulose was disintegrated into gel-like cellulose slurry by ultrasonic-2, 2, 6, 6-tetramethylpiperidinyloxy (tempo) oxidation method. Four different multifunctional biocomposites were prepared by incorporating natural resin extract (wild berry) as binder into cellulosic slurry/fish gelatin blend; weight/volume ratio of cellulose slurry (2%), cellulose slurry/resin (0.01%), Cellulose slurry/fish gelatin (2%) and cellulose slurry/resin/fish gelatin. The effect of combining cellulose, resin, and gelatin on the physicochemical, thermal, mechanical, and uv-blocking properties of the resultant composites were analyzed. The results showed that resin caused a reduction in tensile strength; however, the elongation at break substantially improved from 9.1% To 32.2% And completely blocked uv-light. Fourier-transform infrared analysis revealed covalent interaction and hydrogen bonding between cellulose/gelatin and resin. Moreover, all the films exhibited high thermal decomposition temperatures and can resist temperatures up to 250 degc. The developed hemp-derived cellulose-based bioplastic is unique in this area and has potential as a packaging component in industrial manufacturing as a green material to maintain the quality of food and pharmaceutical products.

GENETICS, GROWTH, AND CULTURE SESSION 1 - ORAL/PLATFORM
IMPACT OF IBA CONCENTRATION AND FORMULATION AND PROPAGATION ENVIRONMENT ON ROOTING SUCCESS OF 'I3' HEMP BY STEM CUTTINGS
Presenter - Adigun Mcleod, Adigun Mcleod, Kelly Vining, Tyler Hoskins, Ryan Contreras

As the industrial hemp (cannabis sativa) market grows, there is a need for improved methods to clonally propagate new cultivars. To date, there is a lack of information on optimizing vegetative propagation of hemp. The purpose of this study was to evaluate how three different variables [propagation environment, indole-3 butyric acid (iba) formulation, and iba concentration] affected the rooting percentage, root quality, and shoot quality of stem cuttings from 'i3', a cannabinoid-free clone of industrial hemp. Propagation environments tested were intermittent mist and sub irrigation under a humidity dome. Iba formulations tested were talc rooting powder, and iba in solution. Concentrations tested for both iba formulations were 0, 3000, or 8000 ppm (1 ppm = 1 mg/l). Under mist or domes, rooting quality and percent declined at 8000 ppm iba. Root and shoot quality and rooting percentage also were reduced in 3000 ppm iba in solution treatment compared to talc. Our data show that for the cultivar tested, cuttings rooted at the highest percentage and produced the highest-quality roots and shoots with either no hormone or 3000 ppm talc. These treatments did equally well under humidity domes or intermittent mist. In conclusion, our research shows that growers can successfully root stem cuttings by using both humidity domes and intermittent mist, and without using rooting hormone. We found that 3000 ppm talc powder was superior to iba in solution at the concentrations we tested, and found that 8000 ppm was detrimental to success, regardless of formulation.

ORAL & PANEL ABSTRACTS
Monday, August 8

2:30 PM - 2:55 PM
GENETICS, GROWTH, AND CULTURE SESSION 1 - ORAL/PLATFORM
TERPENE SYNTHASE CHARACTERIZATION IN TWO CULTIVARS ON SHIMADZU TQ-8040 GAS CHROMATOGRAPHY WITH SELECTIVE ION MONITORING
Presenter - Anthony Torres | Anthony Torres, Keith Allen, Christopher Pauli, Caleb King, Thomas Blank, Kymron Decesare, Donald P. Land, Chris Zalewski, Reginald J. Gaudino

Cannabis sativa, a diecious angiosperm, has long history of domestication by humans tracing back to neolithic times (Ren2021, Tihelka 2021). The plant has been highly sought for its medicinal metabolites and is most well-known for its bioaccumulation of specialized compounds called cannabinoids and terpenoids. Monoterpenes such as terpinolene, alpha-pinene, and beta myrcene undergo enzymatic synthesis from the precursor geranyl pyrophosphate (gpp), while sesquiterpenes such as beta caryophyllene, beta farnescene, and alpha bisabolol are synthesized from the precursor farnesyl pyrophosphate (fpp)(bohlmann 2011). To assess the activity of specific terpene synthase genes among cannabis varieties in our germplasm, we utilized molecular cloning and functional gene characterization techniques to clone and characterize dominantly expressed terpene synthase genes tps37 and tps20 genes from two front range biosciences varieties using an e coli bacterial expression system. We performed downstream enzymatic characterization after supplementing the purified enzyme with fpp/gpp substrate in an in vitro assay. Synthesized assay products were analyzed by selective ion monitoring (sim) on a shimadzu tq8040 to characterize the enzymatic activity. We found that tps37 produced terpinolene from gpp as a dominant product with several terpenes (alpha-cedrene, alpha-phellandrene, alpha-pinene, alpha-terpinene, alpha-terpineol, beta-myrcene, beta-pinene, e-beta-ocimene, and gamma-terpinene) present in lower quantities. We found that tps1 and tps2 from both varieties produced limonene and alpha pinene, respectively. Many of the lower abundance terpenes coming from tps37 may not have been detected with a single quad gcms, highlighting the need for more sensitive instruments in this type of work. We also found that closely related versions of tps20 had differential activity with the substrate FPP.

MATERIALS, PROCESSING, AND PRODUCT MANUFACTURING SESSION 1 - ORAL/PLATFORM
OPTIMIZATION OF SUPERCRITICAL FLUID EXTRACTION OF CANNABIDIOL FROM CHERRY BLOSSOM HEMP STRAIN
Presenter - Joonhee Han, Min Hong , Tae-hyung Kwon

Chuncheon bioindustry foundation (cbf), a non-profit organization established by chuncheon city in korea, that aims to promote the bio industry by providing comprehensive support bio companies. In last year, cbf was designated project 'research and development for korean type hemp platform of gangwon green bio' by the ministry of science and technology in korea. The project consists of 3 aims and involved universities, companies, research institute including institute of cannabis research (icr): (1) development of korean hemp cultivars and cultivation conditions that contain high cannabinoid contents, (2) establishment of cannabinoid extraction methods and pharmaceutical research, (3) industrialization of cannabinoid for foods, cosmetics, and pharmaceuticals. The objective of this work was to establishment for cbd extract condition of supercritical fluid extraction (sfe) from cherry blossom (cannabis sativa l.) By response surface methodology (rsm). At a first, we investigated optimize condition of decarboxylation for cannabidiolic acid (cbda) to cbd using rsm. The influence of 2 independent factors (temperature 90~130℃, time 30~180 min) was evaluated on decarboxylation of cbda to cbd. The cannabinoid contents of the extracts were determined with hplc analyses. The response predictions obtained at optimum conditions of temperature 125℃, time 50 min were decarboxylated 99% or more of cbda to cbd. To the development of sfe methods, cbd extraction was performed under 15 different conditions and analyzed by rsm. The effect of 3 independent factors (pressure 20~50mpa, temperature 35~70℃, time 60~120 min) was determined on the extraction of total cbd (cbda+cbd) without co-solvent. As a result, the rsm prediction obtained highest 68.25G of cbd yield at pressure 47mpa, temperature 60℃, time 105min. Based on these results, it is expected to make a great contribution to the industrialization of korean hemp. Furthermore, the developed cbd will be used for research on various products and pharmaceuticals.

GENETICS, GROWTH, AND CULTURE SESSION 1 - ORAL/PLATFORM
ULTRASTRUCTURE OF HEMP SEED
Presenter - Adigun Mcleod, Adigun Mcleod, Kelly Vining, Tyler Hoskins, Ryan Contreras

Hemp seed has been used as an important source of nutrition for thousands of years. Our research sought to describe the micro-morphology of a fiber-type hemp seed 'chungsam' using light microscopy, scanning and transmission electron microscopy. The hemp seed coat consisted of exotesta and endotesta. The exotesta was a mechanical layer with lignified and elongated cells, while the endotesta of the underlying layers of the exotesta consisted of two separated cell layers. The collapsed outer layer of endotesta showed unique reticulate structures, however, the inner layer was thin and seems to be membranous.

Hemp seed typically contains 25% protein and 30% lipid. We observed protein bodies which varied from 1.8 To 5.1 0X000b5m in diameter with a protein matrix containing electron-dense globoid crystals. These protein bodies were surrounded by numerous lipid bodies in the cotyledon cells ranging from 0.8 To 3.2 0X000b5m in diameter. It appears that the high-quality proteins, edestin and albumin, are present in these protein bodies, although our morphological techniques could not distinguish their protein composition. We discerned in some samples signs of early degradation, as protein bodies changed to a granular appearance and lipid bodies degraded and eventually fused with one another. The degradation process of protein and lipid bodies of cotyledon cells might correlate with reports that hemp seeds rapidly lose their ability to germinate.

ORAL & PANEL ABSTRACTS
Monday, August 8

2:55 PM -3:20 PM
MATERIALS, PROCESSING, AND PRODUCT MANUFACTURING SESSION 1 - ORAL/PLATFORM
PROPERTIES OF MILLED HIGH-CANNABINOID HEMP STALK RESIDUES AND POTENTIAL FOR VALUE-ADDED APPLICATIONS
Presenter - Hanah Rheay |Catherine Brewer

"Production of hemp (cannabis sativa l.) In new mexico has been primarily dominated by high-cannabinoid crops since the state's legalization in 2018. As a result of the regional focus on cannabinoid products, there is a lack of infrastructure for traditional fiber processing. Traditional hemp fiber processing for textiles and building materials requires use of a decorticator, a specialized piece of equipment that separates the hurd and bast fibers from the stalks. Although the number of decorticators in the u.S. Has increased since hemp's re-legalization, the use of the machines is heavily localized since the feedstocks must come from within short distances for the process to be economically viable. As such, the majority of u.S. Hemp producers treat their crop residues as waste as they do not have access to fiber processing.

An alternative for breaking down hemp stalks is milling. Milled fiber has increased surface area access for functionality and reactivity in downstream processing. Two hemp fiber products that can utilize milled fiber material are biofuels and wood-substitutes. The suitability of new mexico-grown high-cannabinoid hemp residues for these applications is being investigated through physical and chemical characterization. In addition to particle size distribution, density, and uniformity, the homogenized residues are being evaluated for lignin, cellulose, extractives, volatiles, moisture, and ash contents; mineral and elemental (chns) compositions; and calorific values. The resulting characteristics are compared to feedstock requirements for biofuel production (such as sustainable aviation fuel) and wood-substitute manufacturing. In order to sustain (high-cannabinoid) hemp production in new mexico, identification of value-added products from the crop residues is critical. Understanding the applications of fiber from high-cannabinoid varieties, compared to hemp varieties bred for fiber, can add additional value to the medicinal and recreational cannabis industries in the state.

3:20 PM - 3:50 PM
HUMAN HEALTH AND MEDICINE SESSION 1 - ORAL/PLATFORM
CANNABIS SCIENCE: THE FOUNDATION OF BUDDING HEMP AND CANNABIS INDUSTRIES
Presenter -Jessica Knox, MD, MBA

"From policy making to product manufacturing to clinical and personal care, sensible and effective approaches to the cannabis plant rely upon a firm understanding of how the plant works in the human body. Yet, from state to state, policies, regulations, manufacturing trends, clinical guidelines, and even public perspective rarely reflect a basic command for the science. The consequence? Discordance between policy, industry objectives, clinical standards and efficacy, and consumer goals and experiences.

Such an understanding begins with an orientation to the endocannabinoid system - the physiologic system responsible for maintaining the body's homeostasis and the system that mediates the myriad effects of cannabis - and to the pharmacology of cannabis - the plant's active ingredients and what they do in the body.

In this introduction to cannabis science, we examine how cannabis works through the physiology of the endocannabinoid system (ecs) and the pharmacology of the plant itself. With these basics established, we explore the implications of this science to clinical care, industry best practices, policy and regulation, and ultimately health equity.

LIVESTOCK AND COMPANION ANIMALS/PETS SESSION 1 - ORAL/PLATFORM
EFFECTS OF INDUSTRIAL HEMP (CANNABIS SATIVA) SUPPLEMENTATION ON BEHAVIOR OF ANGUS CATTLE
Presenter - Kendra Jones | K. Jones, D. Allen, F. Samuel, N. Ogunkunle, F. Zakari, E. Cebert, X. Kuang, B. Omontese

"The welfare of beef cattle can influence health, growth and performance. Beef cattle are routinely exposed to stressful conditions including disease, regrouping, transportation and weaning. Hemp (cannabis sativa) supplementation has been shown to be promising in stress mitigation and able to alter behavior of cattle. This study was designed to evaluate the effects of industrial hemp (ih) on behavior of beef cattle. Twenty apparently healthy cattle with body condition scores of 6.0 (Range 1-9) were randomly allocated to one of two groups: con (n=10) and hemp (n=10). Hemp cattle grazed native pastures and received daily 30g/200g of hemp supplementation for 7 days. Similarly, con grazed native pastures and received 200g commercial grower feed without hemp. Activity and behavioral patterns were observed by using a digital camera and recorded for 20 minutes daily. Overall, hemp were twice more likely to be lying down (61.5 Vs 38.5%), Grazing (64.7% Vs 35.3%), And drinking water (70% vs 30%) compared with con, respectively. However, con was more excitable compared with hemp (73.5 Vs 26.5%). Overall, there was no difference in the proportion of cattle standing. The observed behavioral pattern suggests that ih supplementation could improve the welfare of beef cattle.

ORAL & PANEL ABSTRACTS
Monday, August 8

3:50 PM - 4:20 PM

HUMAN HEALTH AND MEDICINE SESSION 1 - ORAL/PLATFORM

CANNABINOID HYPEREMESIS SYNDROME: IDENTIFICATION AND SURVEILLANCE

Presenter - Richard Holdman, Delayna Goulding, Elyse Contreras

Background: as legal cannabis becomes accessible across the us, it is imperative to accurately identify and monitor health outcomes resulting from cannabis use. One example is Cannabinoid Hyperemesis Syndrome (CHS), or cyclic vomiting resulting from long-time, daily, or near-daily cannabis use. Despite development of rome iv criteria to diagnose chs in 2016, the broad differential diagnosis of nausea and vomiting can result in a delayed diagnosis, and a patient's hesitancy to disclose cannabis use could result in underdiagnosis.

Methods: information on chs was gathered through an ongoing systematic review of scientific literature performed by the colorado department of public health and environment's marijuana health monitoring program. Colorado health association (cha) data from 2020 was used to gather information about how cannabis-related emergency department (ed) visits are characterized. International classification of disease (icd-10-cm) codes used for all presentations indicating cannabis use are described and used to provide the annual discharge rate.

Results and discussion: scientific literature has shown long-time, daily, or near-daily cannabis use is associated with severe recurrent vomiting or chs. Many case reports and review articles have detailed the signs and symptoms associated with chs, leading to development of rome iv criteria to diagnose chs. There is also evidence that cessation of cannabis use may be associated with relief of chs symptoms. However, there are no icd-10-cm codes specific to chs, and combinations of vomiting codes with cannabis codes have also shown to perform poorly. Findings from 2020 cha data showed an annual ed discharge rate with at least one cannabis billing code present to be 787.7 Per 100,000 discharges (95% ci: 774.0, 801.7), Which suggest a very broad range of non-specific outcomes. Icd-10-cm codes used to designate cannabis use within cha data can be split into two general groups helpful in associating exposure to outcome: ""cannabis abuse, dependence, or use"" codes and "poisoning by cannabis or adverse effect of cannabis" codes.

Conclusion: development of chs is associated with long-time, daily, or near-daily cannabis use and relief of symptoms may be associated with cessation of cannabis use. Increased awareness among health care clinicians of the signs, symptoms, and rome iv criteria of chs is needed to ensure accurate diagnosis and coding of cannabis-related hospitalizations or ed visits, especially in states with legal, accessible cannabis. As more knowledge emerges surrounding cannabis-related health outcomes, development of specific icd-10-cm codes should be considered. Consistent and accurate use of codes in hospital and ed settings ensures accurate public health surveillance on health outcomes associated with cannabis use.

3:50 PM - 4:20 PM

LIVESTOCK AND COMPANION ANIMALS/PETS SESSION 1 - ORAL/PLATFORM

PALATABILITY OF HEMPSEED MEAL PELLETS COMPARED TO MAINSTREAM FEEDSTUFFS IN HORSES

Presenter - Ryon Springer, Teighlor D. Cross, Kallyn S. Ciesynski, Lillian F. Esterl-Byrne, Caitlan C. Thorne, KImberly A. Guay, Kimberly B. Wellmann, Trinette N. Jones

When the 2014 and 2018 us farm bills legalized hemp (cannabis sativa l.), Increased farming created an abundance of hemp by-products. Hempseed meal (hsm) is a by-product of hempseed oil extraction. With increasing availability, hemp must be evaluated as a potential feedstuff for sustainable livestock systems. The objective of this study was to evaluate the palatability of hsm as an equine feedstuff. The study used a modified 3x3 latin square design utilizing 3 mature geldings (g; 7.3 +- 2.5 Yr) and 3 mature mares (m; 12.5 +- 6.5 Yr) blocked by sex. Basal feed consumption and bucket preference was established during a washout period of 2 feedings/d over 3 days before each period. During each treatment period (3d) horses were offered either 500g of soybean meal pellets (sbm), rice bran pellets (rbp), or beet pulp pellets (bpp) in one bucket and 500g of hsm in a second bucket each feeding. Feed treatments were switched between bucket positions each feeding. Findings are presented as mean +- sem. Data were analyzed using an anova within r statistical program©. The study found that hsm consumption (351.2 +- 30.6G) did not differ with treatment (p = 0.63), Bucket (p = 0.94), Or sex (p = 0.67). Hsm consumption was greater than sbm (237.7 +- 34.8G; p = 0.005) And bpp (37.0 +- 9.3G; p<0.001) But was not different from rbp (299.1 +- 35.2G; p = 0.19). Hsm consumption increased with each subsequent period (period 1: 229.6 +- 33.4G; period 2: 381.3 +- 27.1G; period 3: 442.6 +- 17.2; P < 0.001). These findings indicate that hsm may be more palatable than sbm and bpp but similar to rbp. Hsm consumption may continue to increase over time. HSM may serve as an acceptable replacement to more common feedstuffs used in equine rations.

ORAL & PANEL ABSTRACTS
Monday, August 8

4:20 PM - 4:50 PM

HUMAN HEALTH AND MEDICINE SESSION 1 - ORAL/PLATFORM

FETAL CANNABIDIOL (CBD) EXPOSURE AFFECTS HYPOTHALAMUS DEVELOPMENT AND GLUCOSE TOLERANCE

Presenter - Emily Bates | Karli Swenson, Rebecca O'Rouke, Emily Bates

Background: pregnant women consume cannabidiol (cbd), a non-psychoactive cannabis cannabinoid, because it can help with morning sickness and public perception is that it is safe. But maternal consumption allows cbd to diffuse from the mother to the fetus, and the receptors that it activates regulate important developmental processes. Fetal exposure to cbd activates peroxisome proliferator-activated receptor (ppar)g which promotes increased food intake and adiposity, and thus may affect metabolic function, energy balance behaviors, and susceptibility to diabetes in offspring. Fetal exposure to another ppar agonist called rosiglitazone reduces expression of several components of the insulin signaling pathway and glucose transporters in fetal sheep cardiac muscle. Pparg is expressed in the hypothalamus, the liver, the pancreas, adipose tissue, and other organs that regulate metabolism during fetal development. Thus, we hypothesized that fetal cbd exposure impacts postnatal feeding behavior, glucose tolerance, and metabolism in mice.

Methods: we administered cbd or vehicle to pregnant dams throughout gestation (e5.5-Birth) and performed single cell rna sequencing on cells from the hypothalamus in male and female mice from both exposure groups. We tested glucose tolerance in adult male and female mice from both exposure groups.

Results and discussion: we found significant differences in expression of genes that are important for regulation of feeding behavior, insulin signaling, and adiposity in cbd exposed pups. Cbd's effect on subset of differentially expressed genes was dependent on sex of the animal. We found fetal cbd exposure significantly reduced glucose tolerance in male mice, but not female mice.

Conclusions: our results indicate that fetal cbd exposure impacts the transcriptional profile of the hypothalamus in a way that predicts differences in feeding behavior, energy balance, and insulin signaling. Prenatal exposure to cbd may impact glucose tolerance in adults in a sex dependent manner.

4:20 PM - 4:50 PM

LIVESTOCK AND COMPANION ANIMALS/PETS SESSION 1 - ORAL/PLATFORM

SHORT TERM FEEDING OF INDUSTRIAL HEMP: PLASMA CANNABINOID CONCENTRATIONS, BEHAVIOR OUTCOMES, AND IMMUNE MODULATION IN HOLSTEIN STEERS

Presenter - Michael Kleinhenz | Michael D. Kleinhenz, Mikaela Weeder, Shawnee Montgomery, Miriam Martin, Andrew Curtis, Geraldine Magnin, Zhoumeng Lin, Jason Griffin, Johann F. Coetzee

Background: Industrial hemp (ih) is defined as cannabis sativa containing < 0.3% Delta-9 tetrahydrocannabinol (thc) and was legalized in the 2018 farm bill. The impact of cannabinoids in ih fed to livestock, especially after repeat exposure, has not been thoroughly investigated.

Methods: this study was approved by the iacuc at kansas state university (#4421). Sixteen male castrated holstein cattle weighting (+-sd) 447 +- 68 kg were enrolled onto the study. Cattle were allocated into two treatment groups either receiving ih (hemp, n = 8) or a control (cntl, n = 8). Cattle in the hemp group were fed 25 g ih mixed in 200 g of grain once a day for 14 days to target a daily dose of 5.5 Mg/kg of cannabidiolic acid (cbda). Behavior was continuously monitored with accelerometers and blood samples were collected at predetermined time points for plasma cannabinoid, serum cortisol, serum haptoglobin, liver enzymes, serum amyloid a, and prostaglandin e2 concentrations.

Results and discussion: mean plasma cannabinoids reached peak concentrations after the first dosing at 16.7 H and a mean terminal half-life of 15.3 H was observed. A mean accumulation index of 1.52 Was determined for repeated dosing. The hemp group spent a mean 14.1 H/d (95% ci: 13.6 - 14.6 H/d) lying compared to the 13.4 H/d (95% ci: 12.9 - 13.8 H/d) for the cntl cattle (p =0.03). Cortisol concentrations in the hemp group were lower than the cntl group (p = 0.001). Cattle in the hemp group demonstrated an 8.8% Reduction in prostaglandin e2 concentrations from baseline compared to a 10.2% Increase from baseline observed in the cntl group. No differences for haptoglobin or serum amyloid a were observed. Liver enzymes remained within normal limits for the entire study period in both treatment groups.

Conclusion: these results suggest that feeding ih with a high cbda content for 14 days increases lying behavior and decreases biomarkers of stress and inflammation in cattle with low risk of accumulation in the body.

ORAL & PANEL ABSTRACTS
Monday, August 8

4:50 PM - 5:20 PM
HUMAN HEALTH AND MEDICINE SESSION 1 - ORAL/PLATFORM

PRELIMINARY DATA COMPARING THE EFFICACY OF ACUTE VAPORIZED CANNABIS TO ORAL OXYCODONE AND PLACEBO FOR CHRONIC SPINE PAIN

Presenter - Alan Morris | Rahwa Netsanet, Jacci Bainbridge, Vikas V. Patel, Rachael Rzasa Lynn, Emily M. Lindley

Background: back and neck pain are highly prevalent and disabling musculoskeletal conditions. Although commonly prescribed, opioids are often ineffective and can result in dependency and lethal overdose. An alternative analgesic treatment that has gained increasing recognition is cannabis. The primary aim of this double-blind crossover trial is to compare the efficacy of acute cannabis exposure to a commonly prescribed opioid (oxycodone), as well as placebo, for spontaneous pain relief.

Methods: after informed consent and screening, participants attended 3 separate 4-hour study visits with pre- and post-drug assessments including NRS pain scores, neurocognitive assessments, subjective ratings of drug effects, and pain thresholds (pth) measured with a computer-controlled pressure algometer. Participants received one of the following drugs across the 3 visits: active vaporized cannabis (placebo capsule), active oxycodone (placebo cannabis), and placebo/placebo. Blood samples were taken at baseline, +5 minutes, and +1 hour. Enrollment continues in this study, thus final data analyses have not been completed. Descriptive statistics were performed on a subset of data collected from participants who completed all three study visits. The data remain blinded and are shown as drugs a, b, and c (3 drug treatments: cannabis, oxycodone, and placebo). Data are presented as means.

Results and discussion: to date, a total of 26 participants with chronic spine pain (12 males, 14 females) have completed the study. Patients who received drug a and c reported a reduction in spine pain, although the reduction was greater following the administration of drug a than with drug c (2.2 Points on the nrs pain score vs 1 point, respectively). Patient global impression of change scores showed that drug a was perceived as superior to drugs b and c on improving activity limitations, symptoms, emotions, and overall quality of life related to the spine condition. Subjective drug effect ratings show that drug a had an immediate drug effect following administration, including the sensation of feeling high and sedated. Drugs b and c had fewer subjective drug effects. All three drugs have similar, low ratings for desiring more drug. Serum cannabinoid levels and neurocognitive results are pending.

Conclusions: these initial data appear to show that chronic spine pain is alleviated by drug a, and to a lesser extent, by drug c. Subjective drug effect ratings show that drug a has a rapid onset of effects that tapers off over time, while drugs b and c have fewer subjective effects. A measure of abuse liability found low ratings for desiring all three of the study drugs. The study is still recruiting and final results are expected to be completed by mid-2023.

LIVESTOCK AND COMPANION ANIMALS/PETS SESSION 1 - ORAL/PLATFORM

THE PRESENCE OF CANNABINOID RECEPTORS IN THE BOVINE OVARY

Presenter - Emily Purnell | Kimberly Guay, Cheyenne Runyan, David Roper

The role of the endocannabinoids in regulating female reproductive processes such as follicular development has become an area of heightened interest with the prevalence of cannabidiol (cbd) increasing as a natural mediator to physiological issues as well as the addition of hemp meal as a feedstuff for livestock. Initial studies indicate that cannabis use including δ9- tetrahydrocannabinol (thc) has negative implications on folliculogenesis and multiple aspects of pregnancy. However, there is limited knowledge on the effect of cbd on follicular growth and ovulation. The objective of this study was to identify the presence of the endocannabinoid system (ecs) in bovine ovarian theca and granulosa cells and its effect on follicular dynamics leading to ovulation. Theca and granulosa cells from medium (<4 mm) and large (<4 mm) follicles from abattoir bovine ovaries (n=61) were collected. Upon completion of pooling theca and granulosa cells, protein was isolated for detection of cannabinoid receptors, type 1 (cb1) and type 2 (cb2) through western blot. Receptors cb1 and cb2 are g- protein coupled receptors with effect on the adenylyl cyclase pathway, which is key to many reproductive functions in the ovary. A strong visual representation of cb1 receptor detection was found in large granulosa cells and theca cells. Using stain-free total protein measurement as the loading control, the densitometric ratio in medium granulosa cells and large granulosa cells had greater abundance of cb2 ($p<0.05$) Compared to theca cells. This data suggests a detectable effect by cannabinoids on granulosa and theca cells. Future studies are needed to investigate the role the ecs has in folliculogenesis and key steroidal production for successful ovulation. The subsequent knowledge is a key first step in understanding the effect cbd has on fertility and pregnancy in livestock.

ORAL & PANEL ABSTRACTS
Tuesday, August 9

9:50 AM - 10:20 AM
BUSINESS SESSION 1 - PANEL DISCUSSION
LEVERAGING ESG FRAMEWORK TO BUILD STABLE PUBLIC-PRIVATE PARTNERSHIPS FOR COMMUNITY ACCESS & EQUITY IN THE CANNABIS INDUSTRY
Presenter - Dasheeda Dawson

Since legalization of california for medical use over 25 years ago, the legal cannabis industry has not had the appropriate balance in legal market dynamics to drive better outcomes for the communities legalization was intended to serve. As such, the rewards of the industry have been relatively limited and/or short-lived. Private sector companies with tons of initial capital investment experience volatile rise and fall, while small business operators struggle for survival in the hyper-regulated environment. The government is aggressively and oppressively regulating and taxing to control the market revenue, but they continue falling short of projections with very little integration of the multibillion dollar unregulated cannabis economy. And, the community suffers most as it remains under-educated and under-resourced, impeding access to the legal cannabis industry as patients, professionals, entrepreneurs and everything in between.

In theory, at the intersection of government, business and community are more stable and equitable frameworks built on shared principles and innovative public-private partnerships. More than just the newest buzz word, environmental, social and governance (esg) frameworks provide a systematic approach for government, business and community leaders to identify, assess and integrate best practices and policies to build stable public-private partnerships that demonstrate the full potential of the cannabis legalization movement. In addition to discussing how esg plays a role in long-term sustainability of the industry, this session provides viable examples in "mainstream" industries as well as a deeper dive into potential opportunities for meaningful public-private partnerships within the cannabis industry.

10:20 AM - 10:50 AM
QUALITY CONTROL SESSION 1 - ORAL/PLATFORM
EVALUATION OF METHODS USED TO SAMPLE HEMP FOR REGULATORY COMPLIANCE TESTING
Presenter - Anna Berim | David R. Gang

Accurate and reliable determination of thc content is critical for industrial hemp producers. While precise, accurate, and reproducible analytical protocols have been established, sampling procedures hold strong potential for bias and require revision and optimization. In response to usda's call for comments on the interim final rule we compared four sampling approaches using plants from five hemp fields in the eastern half of washington state. The ""whole plant remediated"" sampling approach approved by wsda for 2019 requires collection of representative leaf, stem, and flower tissue from top, middle, and bottom thirds of representative plants. The plant material is pooled by tissue type, dried, and mixed at a defined tissue type ratio. This protocol was applied to plants 30 and 15 days prior to intended harvest. The ""top 1/3 plant"" sampling approach approved by usda for 2020 was applied to plants 15 days prior to intended harvest. Only branches from the top 1/3 of the plant are collected by this method. Here, representative plants analyzed individually were compared to randomly sampled aliquots of an aggregate sample composed of the same plants. A portion of pooled ""top 1/3 plant"" material was sent to a second laboratory for independent testing. Ten replicates were analyzed for each variety and sampling approach. Statistical significance of results was established by anova or t-tests as appropriate. As expected, total thc content increased with plant age for most fields. The relative standard deviation (rsd) of the mean thc levels ranged within 3-12% for the remediated samples and was up to 54-67% for the ""top 1/3 plant"" samples. The rsd observed for quality control samples was 0.581%. The inconsistency of results produced with experimental samples is therefore doubtlessly due to sampling methods and not an artifact of analysis. ""Top 1/3 plant"" method proved particularly prone to stochastic effects and hence is unreliable. An additional analysis of portions of the same aggregate ""top 1/3 plant"" mix at four different approved cannabis testing laboratories also returned variable results with total thc levels differing up to 2-fold and confirmed the above conclusions regarding the inadequacy of this sampling technique.

ORAL & PANEL ABSTRACTS
Tuesday, August 9

10:20 AM - 10:50 AM
BUSINESS SESSION 1 - PANEL DISCUSSION
EXPLORING BRAND LOYALTY AND SALIENCE OF PURCHASING ATTRIBUTES AMONG CANNABIS BRANDS AND CONSUMERS
Presenter - Duane Cofield | Victoria Seitz

California is considered by many to be the ""mecca"" of cannabis retail which birthed numerous retailers and brands in the cannabis retail market. Hence the purpose of this study was to determine the extent of brand loyalty (bl) among cannabis users in california. Additionally, the study sought to determine which purchasing attributes were considered important among cannabis users. A survey was conducted to ascertain cannabis use, brand loyalty, and purchasing attributes. A total of 63 surveys were collected. Findings indicated that approximately 75% of participants used cannabis more than 40 times in the past six months and that consumers with higher education had a higher total brand attitude score suggesting greater brand loyalty than those with high school education. Moreover, results showed that cannabis tested for pesticides was the most important attribute in the purchase of the product…implications of the findings were then discussed.

10:50 AM - 11:20 AM
QUALITY CONTROL SESSION 1 - ORAL/PLATFORM
SIMPLIFYING COLORADO'S HEMP PESTICIDE TESTING WORKFLOW REQUIREMENTS WITH FULL LABORATORY AUTOMATION
Presenter - Toby Astill | Avinash Dalmia

With busy compliance cannabis & hemp, labs are increasingly required to test over 1000 hemp samples a month; managing sample and data workflows can be challenging and time-consuming. With dedicated fully automated mass spectrometry workflows, designed specifically for pesticide residue testing, automation handling solutions enable a cannabis lab to minimize errors, improve data quality, reduce hands-on time, and increase throughput and reproducibility. This presentation will present new data and material to show the time savings, the benefit of adding hardware automation to reduce labor requirements when testing hemp samples to meet the colorado hemp pesticide requirements. In addition, data will show the benefit of adding cloud-based software solutions to integrate data across the iso or gmp lab environment. References will show that having a verifiable method, and protocol, for the cannabis and hemp testing industry is key in ensuring the highest quality of cannabis and hemp product reaches the patient or consumer.

BUSINESS SESSION 1 - ORAL/PLATFORM
HEMP COVER CROPPING FOR DRYLAND WHEAT FARMERS: OPPORTUNITIES FOR DISEASE SUPPRESSION AND INCREASED YIELD
Presenter - Christina Hagerty | G. Shrestha, N. Wen, D. Kroese, G. Namdar, A. Wernsing, D. Wysocki

Crop diversification is very low in the rainfall-limited, $2 billion-dollar wheat industry of the dryland pacific northwest (pnw). The predominate cropping scheme includes the winter wheat - summer fallow system where fields are planted to winter wheat in year 1, left fallow for increased water infiltration in year 2, and planted to winter wheat again in year 3. Lack of crop diversification can deplete organic matter and nutrients in soil, all while also can favor the build-up of soilborne diseases. As wheat is harvested from fields biennially, soil can be robbed of nutrients, leading to soil health degradation over time. Cover crops can be used within a standard rotation, and they are used primarily to provide protection against soil erosion, incorporate nutrients, and to break soilborne disease cycles. In this study, we investigated the potential of an industrial hemp (cannabis sativa l.) Cover crop in the dryland wheat rotation to reduce soilborne disease, and thus increase profitability for pnw farmers. While the benefits of barley and mustard cover crops are well understood, the benefits of hemp cover cropping remain unexplained. The hemp plant produces many plant secondary metabolites including over 120 terpenoids and more than 100 cannabinoids (a class of terpenoids unique to cannabis). Cannabinoid and terpenoid compounds have been shown to play a major role in suppressing soilborne disease and improving soil health by diversifying the overall metabolic profile of the soil. We validated this concept in the winter wheat production system, in direct comparison to mustard, barley, and fallow rotations. Two replicated inoculated greenhouse simulations and one replicated field study are complete. Another field study is forthcoming (complete after harvest 2022). Analysis of variance of both greenhouse studies and the completed field study revealed significant treatment differences in soilborne disease. Our preliminary results suggest a hemp rotation in the dryland wheat production system could be a valuable strategy to reduce soilborne disease and improve soil health.

1:15 PM - 1:40 PM
POLICY AND LEGAL LANDSCAPE SESSION 2 - ORAL/PLATFORM
MAKING IMPACT: SMART APPROACHES TO GOVERNMENT ACCOUNTABILITY IN REPAIRING THE WAR ON DRUGS
Presenter - Amber Senter| Amber Senter, Rafi Crockett, Chris Alexander

The lecture portion of this session will focus on highlighting the process and findings of the supernova social equity impact report, recently published in 2022. The report introduces a new performance metric, social return on investment (sroi) which government agencies and the private sector can leverage to determine social impact. Supernova's report helps public and private sector partners see the bigger value proposition beyond simple output metrics – putting social impact into an easily understandable unit, in this case, dollars and cents. Afterwards, panelists consisting of current and past cannabis regulators will discuss the various approaches governments have been making or should be making to repair the war on drugs through policy and regulations, including measuring, monitoring & reporting. Relevant topics covered will include ny state's seeding opportunity initiative, and los angeles spark report & findings.

ORAL & PANEL ABSTRACTS
Tuesday, August 9

1:15 PM - 1:40 PM
EDUCATION SESSION 2 - ORAL/PLATFORM
CANNABIS PROGRAMS AT THE COMMUNITY COLLEGE OF DENVER: INDUSTRY IN THE DRIVER'S SEAT
Presenter - John Frost

The Community College of Denver has recently launched two cannabis education programs reverse engineered in partnership with dozens of industry partners to provide students with the knowledge and skills required to meet the needs of the cannabis industry. By identifying the learning outcomes desired by the cannabis industry first and then building courses and programs to satisfy those learning outcomes, CCD has developed an Associate of Applied Science (AAS) in Cannabis Business and Bachelors of Applied Science in Cannabis Science and Operations degrees. Both programs are fully accredited by the Higher Learning Commission, federally student aid eligible, and enrolling students. In this presentation, we will discuss the programs and the results of the first year enrollment and retention data for the AAS program in Cannabis Business where we found extremely high interest in these programs, exceeding our first year enrollment target by 2.5 times and reaching 64% of our five-year enrollment target in just two semesters. This, along with student course feedback data indicate that there is both a large demand for this material and that students are especially receptive to the industry focused curriculum development approach we've taken. Retention rate data is more nuanced, but shows a second semester retention rate of 81% for eligible students. If this trend persists, it is significantly above the national community college retention rate of 51.6% and again lends credibility that student are engaging strongly with this industry guided applied approach to curriculum development.

1:40 PM - 2:05 PM
EDUCATION SESSION 2 - ORAL/PLATFORM
THE HIGHS & LOWS OF MEDICAL CANNABIS: WHAT MEDICAL STUDENTS, TRAINEES AND OTHER ALLIED HEALTH CARE PROFESSIONALS NEED TO KNOW BUT DON'T
Presenter - Suraj Tandon

Learning Objectives:
- To determine what barriers and knowledge gaps exist if any to the development and implementation of medical cannabis curricula in educational programs.
- To explore the current state of evidence surrounding the availability and interest of medical cannabis curricula.

To understand what resources exist to assist educational programs in the development of competencies-based-curricula.

1:40 PM - 2:05 PM
POLICY AND LEGAL LANDSCAPE SESSION 2 - PANEL DISCUSSION
MAKING IMPACT: SMART APPROACHES TO GOVERNMENT ACCOUNTABILITY IN REPAIRING THE WAR ON DRUGS
Presenter - Amber Senter | Rafi Crockett, Chris Alexander, Ny Cannabis

The lecture portion of this session will focus on highlighting the process and findings of the supernova social equity impact report, recently published in 2022. The report introduces a new performance metric, social return on investment (sroi) which government agencies and the private sector can leverage to determine social impact. Supernova's report helps public and private sector partners see the bigger value proposition beyond simple output metrics – putting social impact into an easily understandable unit, in this case, dollars and cents. Afterwards, panelists consisting of current and past cannabis regulators will discuss the various approaches governments have been making or should be making to repair the war on drugs through policy and regulations, including measuring, monitoring & reporting. Relevant topics covered will include ny state's seeding opportunity initiative, and los angeles spark report & findings.

ORAL & PANEL ABSTRACTS
Tuesday, August 9

2:05 PM - 2:30 PM
EDUCATION SESSION 2 - ORAL/PLATFORM
CANNABINOID MEDICINE EDUCATION IN LATIN AMERICA : CHALLENGES AND OPPORTUNITIES
SANDRA CARRILLO, MD
Presenter - Sandra Carillo, MD

A discussion will focus on the availability of cannabis education for doctors and health care practitioners in Latin America and the importance of Education Based in Scientific Evidence. I will be addressing the challenges many doctors face, since education is expensive and time is limited, and how important is to get in alliance with universities and governments in order to facilitate access to education.

2:05 PM - 2:30 PM
POLICY AND LEGAL LANDSCAPE SESSION 2 - ORAL/PLATFORM
HEMP LAW UPDATE -- 2022
Presenter - Marnie Coit

One constant is that things are always changing in hemp law. 2022 marks the first year that all states and tribal governments will be operating under the authority of the 2018 Farm Bill. We will discuss the highlights of the USDA's Final Rule for the Domestic Production of Hemp. And now that everyone is operating under the same regulations under the 2018 Farm Bill it is time to renew the Farm Bill. We will look ahead to what changes may be made under the next farm bill, which is expected in 2023.

2:30 PM - 2:55 PM
EDUCATION SESSION 2 - ORAL/PLATFORM
THE INTERSECTION BETWEEN EDUCATION AND WELLNESS IN CANNABIS CULTURE
Presenter - Adam Abodeely, MD, MBA, FACS, FASCRS

Globally, cannabis consumption has been defined as either for medicinal purposes or as a recreational ingredient to alter perceptions, feelings, and emotions. We continue to educate medical providers on the proper way to use cannabis safely and effectively as a medicine for a variety of diseases and symptoms associated with these conditions. At the same time, for cannabis to be accepted by society for recreational purposes, education has become paramount in proving that products have quality assurance while at the same time can be responsibly used for "recreational" purposes. Most cannabis consumers don't fall into either category. In this presentation, we will explore the idea of cannabis as a wellness offering and how education around this emerging sector might take shape.

2:30 PM - 3:20 PM
POLICY AND LEGAL LANDSCAPE SESSION #2 - PANEL DISSCUSSION

2:55 PM - 3:20 PM
EDUCATION SESSION #2 - PANEL DISCUSSION

ORAL & PANEL ABSTRACTS
Tuesday, August 9

3:20 PM - 3:45 PM

GENETICS, GROWTH, AND CULTURE SESSION 2 - ORAL/PLATFORM

CHARACTERIZATION OF SOIL BACTERIA FROM CANNABIS SATIVA L. AND ITS EFFECTS ON SEED GERMINATION

Presenter - Ingrid Carolina, Corredor Perilla | Jairo Leonardo Cuervo, Sang - Hyuck Park

This study investigates soil bacteria's symbiotic effects on cannabis plants. The authors assessed the cannabis soils obtained from two locations in the central west of colombia - salado-ibague, and mariquita. Among 265 bacteria being detected, 21- and 10-gram positive bacteria from salado-ibague and mariquita were selected, respectively. Bacteria effects on seed germination were assessed. Our germination assay showed that four bacillus ecotypes significantly reduced the germination rate (n=36, 10-40%) while two bacilli (bac-8s and bac-11s) did not affect (n=36, 100%). The germination rate was correlated with root length (r 2= 0.82), Which in turn was correlated with cotyledon development (r 2= 0.84). To determine if bacilli have inhibitory effects on the mycelium growth of a fungal pathogen fusarium oxysporum, our antagonism assay showed that eight bacilli effectively inhibited the mycelium growth of the phytopathogen. The highest antagonistic activity was observed in a bacillus (bac-11s), which significantly reduced the radial growth of the fungus from 4.6+-0.2 Cm (control) to 2.1+-0.2 Cm (n=37, p<0.05). Also, phosphorus (p)-solubilization index (psi) was measured from the bacillus that was grown in insoluble phosphorus medium (tricalcium phosphate). Five bacilli showed a significantly improved phosphate solubilization index, among them, bacillus (bac-19s) could solubilize the phosphorus medium into usable phosphorus (n=37, psi;4.3+-0.7). Our study demonstrates the effects of soil bacilli in the seed germination, development, and phosphorus solubilization while inhibiting the microbial pathogen f. Oxysporum. These findings offer insight into the symbiotic relationship of soil-born bacillus with cannabis plants which could have promising benefits for the cannabis industry's yield, as the bacilli identified in this research could serve as potential bioinoculants in the early stage of cannabis cultivation.

3:45 PM - 4:10 PM

HUMAN HEALTH AND MEDICINE SESSION 2 - ORAL/PLATFORM

CANNABIDIOL AND THE CORTICORAPHE CIRCUIT IN POST-TRAUMATIC STRESS DISORDER

Presenter - Elizabeth Alexander | Maryam Vasefi

Psychiatric disorders, including post-traumatic stress disorder (ptsd), major depressive disorder (mdd), and anxiety disorders, are common consequences of trauma and stress exposure. Specifically, ptsd is associated with trauma-related re-experiencing (flashbacks), impaired fear extinction, and dysregulation of stress coping. Fmri studies suggest significant structural and functional changes in the ptsd-afflicted brain, including mpfc hypoactivity, amygdala hyperactivity, and reduced hippocampal volume. These fear network changes impair fear memory processing and extinction, while frequent exposure to reminders facilitates reconsolidation of fear memory. The corticoraphe circuit includes the 5-ht projections from the dorsal raphe nucleus (drn) to mpfc, and glutamatergic projections from the mpfc to drn. The impact of ptsd on the drn is not yet documented in humans, but drn hyperactivity was observed in rodent models of stress. Cannabidiol (cbd) is a non-psychoactive phytocannabinoid with anxiolytic, antidepressant, and neuroprotective properties, holding promise to treat a variety of psychiatric disorders including ptsd. Cbd has multiple molecular targets, including 5-ht1a receptors and endocannabinoid transmitters. Moreover, multiple studies have documented cbd effects in the fear network. This review employed prisma guidelines to select literature relevant to the objective. The goal of this literature review was to deduce cbd's differential acute and chronic effects in the corticoraphe circuit and other ptsd-related circuitry. We propose that acutely-administered cbd ameliorates amygdala and drn hyperactivity by inhibiting drn-amygdala 5-ht release, while reinforcing the anxiolytic effect via potentiated anandamide (aea) signaling. Reduced amygdala-drn hyperactivity eases strain on mpfc activity, and chronic cbd allows the mpfc to re-gain control over amygdala signaling to favor fear memory extinction over reconsolidation. Mpfc activity is restored via enhanced glutamate release to the drn. Finally, anandamide inhibits drn gabaergic interneuron influence on 5-ht neuron function. In conclusion, cbd potentiates corticoraphe activity to restore mpfc activity to baseline, facilitating fear extinction and improving stress coping.

HUMAN HEALTH AND MEDICINE SESSION 2 - ORAL/PLATFORM

CANNABIDIOL FOR THE TREATMENT OF IRRITABILITY AND AGGRESSION IN CHILDREN WITH AUTISM SPECTRUM DISORDER (CASCADE STUDY): STUDY DESIGN AND BASELINE COHORT TO DATE

Presenter - Nicole Tartaglia | Patrick Romani

Background:
children with autism spectrum disorder (asd) can have co-occurring irritability and aggressive behaviors (iaab). Currently available fda-approved treatments for iaab in asd are limited, have potential adverse effects, often suboptimally treat symptoms, and are not preferred by many parents and/or providers. Following anecdotal and preliminary studies suggesting that cannabidiol (cbd) improves iaab symptoms in asd, the cascade study was designed to more rigorously evaluate the efficacy of cbd for treatment of iaab in asd in a randomized, placebo-controlled trial. Methods: participants with asd age 3 to 17 with baseline iaab's are consented and screened for inclusion/exclusion criteria (comirb 19-2168, clinical trials.Gov nct04520685, fda ind 152270 exempt). Study design is a modified cross-over with 3 arms, including 2 traditional placebo-controlled cross-over arms (12 weeks per treatment / 3 week wash-out), plus a third arm where participants receive cbd for the entire 27 weeks. Randomized participants are titrated to a dose of 10mg/kg/day of cbd or placebo (jazz pharmaceuticals). Primary outcome is the irritability subscale of the aberrant behavior checklist, a parent-report checklist used in previous pivotal trials for iaab treatments in asd (inclusion criteria minimum irritability score=13). All participants are evaluated for baseline autism severity, cognitive and adaptive skills. Additional measures of anxiety, behavior, social communication, sleep, quality of life, family stress, adverse effects, and safety are monitored. With 70 participants we calculate 80% power to detect a difference in irritability score of 5.75 Or greater (alpha=0.05), Assuming 20% placebo response. General linear mixed models will covary for sex and age, and will specify treatment group, time, and group by time interaction. Efficacy will be determined by improvement in irritability score in the cbd group vs placebo after 12 weeks. Results: 45 participants have consented, with 7 screen failures (15.5%). Baseline demographics of 37 randomized participants include: mean age 10.8 Years (sd 3.2, Range 5.5-16.9), Sex 84% male, ethnicity 89% non-hispanic, race 85% caucasian, 3% black, 6% asian, 6% mixed/other. Asd diagnosis was confirmed, mean ados-2 autism severity score is 7.8 (Sd 1.9, Range 3-10). Mean iq 79.8 (Sd 24.7, 47-133), And adaptive functioning composite 57.2 (Sd 17.1, 21-91). Safety monitoring results (adverse events, lab, suicidality) will be presented. There have been no serious adverse events to date. Enrollment will be completed in early 2023, with unblinded study results anticipated in late 2023.

Conclusions: results will help answer important questions related to the safety and efficacy of cbd in the treatment of iaab in ASD.

ORAL & PANEL ABSTRACTS
Tuesday, August 9

3:20 PM - 3:45 PM
GENETICS, GROWTH, AND CULTURE SESSION 2 - ORAL/PLATFORM
EVALUATING NEW BIOSTIMULANTS IN CANNABIS PRODUCTION: A CASE STUDY WITH PINK PIGMENTED FACULTATIVE METHYLOTROPHS (PPFMS)
Presenter - Allison Jack | Jonathan Sprinkle, Allison Justice, CJ Schwartz

Pink pigmented facultative methylotrophs (ppfms) are alphaproteobacteria whose beneficial symbiotic associations with a wide range of crop plants have been well documented in the scientific literature. In order to investigate the potential value of ppfms as biological inputs to commercial cannabis production, we carried out two proof of concept field trials in cbd oil cannabis varieties. In 2020, trials were conducted by sunrise genetics in greeley, co on five varieties within their fl line: fl49, fl58, fl70, fl71 and fl80. Cuttings were immersed in a ppfm bacterial suspension before wounded stems were dipped in synthetic rooting hormone and then cuttings were stuck in transplant media. Rooted cuttings were assessed visually for rooting success and assigned a 0-5 rating based on the percentage of surface area of the plug with visible roots before being transplanted into the field. Plants were harvested and dried and weighed on an individual basis for aboveground dry biomass. All three ppfms included in the study significantly increased visible rooting when applied in addition to synthetic rooting hormone with a range of 10 to 18% increase (significant at p < 0.05 Mann whitney u test, n = 10 plants per treatment, per variety over 5 varieties). All three isolates showed a trend of increased aboveground biomass with a range of 18 to 38% increase (one isolate significant at p < 0.05 Students t-test). The top performing isolate was tested again in 2021 trials conducted by the hemp mine in fair play, sc on their variety ""southern belle"". Ppfms were applied as a transplant liner dip to rooted cuttings on the day of transplanting to field soil. Plants were harvested, dried and weighed on an individual basis, then processed in order to measure the biomass of shucked flowers. Ppfm treated plants showed a 19% increase in total aboveground dry biomass and a 15% increase in shucked flower biomass (trends reported for n = 30 plants per treatment). Ppfms have the potential to add value to commercial cannabis production, both in their ability to enhance rooting of vegetative cuttings and increase flower yield.

4:10 PM - 4:35 PM
GENETICS, GROWTH, AND CULTURE SESSION 2 - ORAL/PLATFORM
EVALUATION OF ESSENTIAL OIL HEMP VARIETIES IN NORTHERN ALABAMA
Presenter - Zaria Smith| Xianyan Kuang, Ernst Cebert

Industrial hemp, or hemp (cannabis sativa l., 0.3% Thc and below), upon its legalization through the 2018 farm bill, has become an important emerging crop in the u.S. Due to its versatility and its environmental benefits. Depending on the end use, hemp can be used for fiber production, seed production, and medicinal purposes. In particular, essential oil hemp (eoh) is one type of hemp that essential oil (e.G., Cbd, cbg) can be extracted from inflorescences to treat a wide variety of physical and mental issues, thereby possessing promising health benefits. Due to the half a century ban and thus knowledge gap in the u.S., However, it is of great importance to evaluate how eoh hemp genetics interact with different growth/environmental conditions. The purpose of this study is to evaluate a number of auto-flowering and full-season eoh varieties for identifying the locally adaptive varieties in northern al. Six and five eoh varieties were planted and evaluated respectively in 2020 and in 2021 as a replicated field trial (randomized complete block design, 4 reps) at the winfred thomas agricultural research station (hazel green, al). For each plot, plant stand, vegetative data, flowering data, maturity data, and post-harvest whole-plant terminal sampling data were collected; stress in weed pressure, insect, and disease were also monitored. Data analysis is now underway and results will be presented. Preliminary analysis suggests these varieties exhibited statistically significant variation in plant height, biomass and cannabinoid profiles. Our work evaluated diverse eoh germplasm in a climate and soil type-specific context and contributes as part to a nationwide uniform eoh variety testing network (led by oregon state univ) that aims to determine optimal environments and practices to produce eoh and to identify potential challenges in growing hemp.

4:10 PM - 4:35 PM
HUMAN HEALTH AND MEDICINE SESSION 2 - ORAL/PLATFORM
THE EFFECT OF FETAL CANNABIDIOL (CBD) EXPOSURE ON BRAIN DEVELOPMENT AND POSTNATAL BEHAVIOR
Presenter - Karli Swenson | Becky O'Rourke, Emily Bates

Morning sickness during pregnancy is a significant burden. Pregnant people are drawn to using marijuana, or the non-psychoactive component cannabidiol (cbd) to treat their nausea thinking it is safe for their developing baby. Seven percent of pregnant women report consuming marijuana and use is likely underreported. Both thc and cbd diffuses down the maternal-placental-fetal pathway and cross the blood brain barrier. Retrospective clinical studies suggest that fetal marijuana exposure is associated with decreased birth weight, poor birth outcomes, anxiety and attention deficit and hyperactivity disorder (adhd). However, these studies are confounded by inadequate dosing information, inability to distinguish the impact of cbd from the psychoactive marijuana component, thc, and frequent concurrent use of nicotine or alcohol. Cbd may contribute to behavioral differences noted in children exposed to marijuana during gestation, yet little is known about how cbd exposure affects brain development and behavior. Cbd activates transient potential villanoid 1 receptor (trpv1), peroxisome proliferator-activated receptor gamma (pparg), and serotonin receptors (5ht1a) which are expressed in the developing hypothalamus. The hypothalamus is a region of the brain that controls stress, feeding behavior, and activity level. Dysregulation of these receptors in-utero can induce physiological and behavioral alterations. To elucidate the impact of cbd exposure on development of the hypothalamus, we administered cbd (50mg/kg) or vehicle to pregnant mice and conducted single cell rna sequencing on the hypothalamuses from the postnatal day 1.5 Pups. Our data revealed differences in gene expression within the hypothalamus based on cbd exposure and sex of the offspring. To determine if cbd contributes to the postnatal behavioral changes associated with fetal marijuana exposure in the clinical studies, we conducted analyses of cognition, memory, anxiety, pain, compulsivity, and metabolism in mice exposed to cbd or vehicle during fetal development. We found a significant difference in cognition in female mice exposed to cbd versus controls. We found a significant difference in thermal sensitivity in males exposed to cbd versus controls. These results are important to communicate because the number of people consuming cbd during pregnancy is increasing.

ORAL & PANEL ABSTRACTS
Tuesday, August 9

4:35 PM - 5:00 PM
GENETICS, GROWTH, AND CULTURE SESSION 2 - ORAL/PLATFORM
MIDWESTERN HEMP DATABASE: A INTERACTIVE DECISION MAKING TOOL FOR EVALUATING PERFORMANCE OF HIGH CANNABINOID HEMP CULTIVARS
Presenter - Phillip Alberti

Hemp is still a "new" crop to the region, with research regarding best management practices (bmps) and cultivar performance in the early stages. Currently, there is a tremendous amount of variability within and across cultivars leaving growers without reliable sources of genetics. The midwestern hemp database (mhd) is a collaboration between land grant institutions, private laboratories, non-profit organizations, and grower cooperators. The mhd leverages grower networks to provide data on production strategies and cultivar performance. Data is uploaded to an interactive, publicly available interface giving growers the ability to review the agronomic performance and cannabinoid development of select hemp cultivars and genetics providers. In 2020 and 2021, over 180 grower cooperators across the midwest participated in this project, submitting over 1400 samples for cannabinoid profiling. Many cbd dominant cultivars exhibit a linear (or curvilinear) relationship between total cbd (%) and total thc (%), as such, total cbd (%) is often not able to exceed ~8% without exceeding the regulatory threshold of 0.3% Total thc (cbd: thc (~25:1)). 25% Of the samples tested were above 0.3% Total thc regulatory limit. Average stripped floral yield of all entries in the mhd was ~1.22 Lbs./Plant. This project will continue in 2022.

Cultivars that exhibit ""good potential"" based on the findings from the mhd were elevated to the cultivar check program (ccp) and studied further via grower-cooperator variety trials across the midwest. In 2021, a group of 14 grower-cooperators participated in a semi-replicated variety involving five cultivars which were sampled for cannabinoid determination at three time points: 3 weeks, 5 weeks, and 7 weeks after flowering initiation; testing was funded via the sustainable agriculture research and education (sare) partnership grant. Cbd: thc of the chosen hemp varieties were relatively unaffected by sample timing and environments, remaining consistent. In addition, cbd: thc of stable cultivars only appear to be impacted by environmental factors on a limited basis. Of the six stable, cbd dominant cultivars grown via the cultivar check program, five (83%) exceeded the threshold for compliant hemp by the week 7 sampling period. In 2022, the ccp has grown to include 34 grower-cooperators and 17 cultivars.

5:00 PM - 5:25 PM
GENETIC, GROWTH, AND CULTURE SESSION #2 - PANEL DISCUSSION

HUMAN HEALTH AND MEDICINE SESSION #2 - PANEL DISCUSSION

ORAL & PANEL ABSTRACTS
Wednesday, August 10

9:00 AM - 9:25 AM

HUMAN HEALTH AND MEDICINE SESSION 2 - ORAL/PLATFORM

CHEM PILLARS OF HEALTH EQUITY: A UNIVERSAL RUBRIC FOR ACHIEVING EQUITY IN AND BY WAY OF THE CANNABIS INDUSTRY AND BEYOND

Presenter - Rachel Knox, Md, PhD |Angela Ledbetter, Ogadinma Obie, Maisha Standifer

According to the oregon health authority, the definition of health equity is "the assuredness of access to full health and wellbeing," a definition shared by the cannabis health equity movement (chem) because of one specific term - "assuredness." Equity is a function of assuredness, a state of certainty. And we believe that access to full health and wellbeing should be certain for all people despite differences and disadvantages created by designations of race, ethnicity, language, disability, age, gender, gender identity, sexual orientation, social class, intersections among these communities or identities, or other socially determined circumstances.

Largely by way of cannabis prohibition, however, the war on drugs made certain the divestment of black and other racially targeted communities of their agency and access to full health and wellbeing. To make matters worse, as cannabis turns legal, policy and regulation are failing to create pathways for the restitution, reparation, and revitalization of the communities prohibition directly harmed. Instead, legal hemp and cannabis–hailed as the fastest-growing and most profitable sectors nationally and internationally–are disproportionately benefiting white, male-led corporations. Legal cannabis sales in 2021 amounted to $25b, up 40% from 2020, generating more than $3.7B in tax revenue. Where is this money going? For what purpose does the legal cannabis industry exist?

As sociological and medical disparities grow only deeper across historically underserved and excluded communities–disparities directly compounded by if not wholly caused by the war on drugs– we are failing to recognize the opportunities that legal hemp and cannabis afford us as we seek solutions to create transformational healing within our most vulnerable communities. The resources the hemp and cannabis industries can generate include but extend far beyond money – by way of its 50,000 uses across agriculture, industry, medicine, and nutrition, cannabis is a uniquely sustainable solution to addressing our most challenging health disparities.

Until now there has been no meaningful way to evaluate cannabis policy, regulation, taxation and use of funds, research, and cannabis innovations as mechanisms for achieving health equity. The chem pillars of health equity™–a rubric developed to measure health equity–provides us with a solution, and it can be applied to any policy, industry, institution, or individual. Using the chem pillars of health equity, we can be certain to demonstrate how much or how little our policies, regulations, use of tax funds, research, and investment in cannabis innovations are tracking towards health equity, information critical to assuring that cannabis legalization makes certain the transformational healing that racially targeted communities deserve.

LIVESTOCK AND COMPANION ANIMALS/PETS SESSION 2 - ORAL/PLATFORM

ACCEPTABILITY OF HEMPSEED MEAL IN HORSES

Presenter - Ryon Springer | Teighlor D. Cross, Paxton L. Turner, Kallyn S. Ciesynski, Lillian F. Esterl-Byrne, Ashley C. Mason, Caitlan C. Thorne, Kimberly A. Guay, Kimberly B. Wellmann, Trinette N. Jones,

Congress passed us farm bills legalizing hemp (cannabis sativa l.), After which hemp-farming increased, resulting in an abundance of hemp by-products, like hempseed meal (hsm). As such, hsm must be evaluated as a potential animal feedstuff. A study was designed to evaluate the acceptability of hsm over time in horses, using 6 stock-type geldings (11.5 +- 3.4Yr, 539.6 +- 31.9Kg, bcs 6). Horses were offered 1 kg of hsm pellets over two 5-min periods, 1 h apart each day, and offered 1 kg of coastal bermudagrass (cynodon dactylon) hay between offerings. Horses remained on a commercial ration during a 1-d feeding-pattern acclimation prior to the 6-d trial. Data (mean +- sem) were analyzed using a repeated measures anova within r statistical program©. One horse was removed from the study due to complete diet refusal. Intake of hsm on d1 (0.287 +- 0.081Kg; $p = 0.062$), D2 (0.378 +- 0.084Kg; $p = 0.07$), And d3 (0.446 +- 0.087; $P = 0.077$) Tended to be lower than d5 (0.695 +- 0.071 Kg). Similarly, d1 ($p = 0.043$), D2 ($p = 0.036$), And d3 ($p = 0.048$) Were lower than d6 (0.652 +- 0.064 Kg). Day 4 (0.530 +- 0.09 Kg) tended to be lower than d5 ($p = 0.09$), But there was no difference between d5 and d6 ($p = 0.73$). Hay consumption was higher on d1 (0.702 +- 0.026Kg; $p = 0.003$) And d2 (0.723 +- 0.041Kg; $p = 0.001$) Than d6 (0.410 +- 0.051Kg). Hay consumption and hsm intake were not correlated ($r2 = 0.001$), But the proportion of hsm consumed between feedings were highly correlated ($r2 = 0.947$), Increasing at 0.4 Of feeding 1. These findings indicate that hsm consumption increases after 4 days of exposure but is not impacted by hay consumption.

ORAL & PANEL ABSTRACTS
Wednesday, August 10

9:25 AM - 10:40 AM

HUMAN HEALTH AND MEDICINE SESSION 2 - PANEL DISCUSSION

CHEM PILLARS OF HEALTH EQUITY: A UNIVERSAL RUBRIC FOR ACHIEVING EQUITY IN AND BY WAY OF THE CANNABIS INDUSTRY AND BEYOND

Presenter - Rachel Knox, MD, Ph.D. | Angela Ledbetter, Ogadinma Obie, Maisha Standifer

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10:15 AM - 10:40 AM

LIVESTOCK AND COMPANION ANIMALS/PETS SESSION 2 - ORAL/PLATFORM, FOLLOWED BY ORAL/PLATFORM

EFFECTS OF FEEDING INDUSTRIAL HEMP (CANNABIS SATIVA) ON CHUTE BEHAVIOR, HEMOGRAM AND SERUM CHEMISTRY OF WEANED BEEF CALVES

Presenter - Felix Samuel | Nathaniel Ogunkunle, Kendra Jones, X. Kuang, Bobwealth Omontese

This study was designed to evaluate the effect of industrial hemp feed supplementation on behavioral and physiological responses of first trimester angus cows. Ten apparently healthy pregnant cows at first trimester, with body condition scores of 6.0 (0-9) Were randomly divided into one of two groups: group 1 (con, n=5) and group 2 (hemp, n=5). The hemp treatment was for 7 days, and samples were collected at the beginning, middle and end of the period. Behavioral parameters (feeding, rumination, resting and activity) were measured using an automated activity monitoring system (moomonitor), while vocalization, chute exit score and vital signs were recorded chuteside. Blood was collected to measure hemogram and serum biochemical parameters. Rectal temperature, respiratory rate, rumination and activity did not differ ($p < 0.05$) Between hemp and con. Also, hemogram and serum chemistry did not differ ($p < 0.05$) Between groups. However, resting duration tended ($p = 0.06$) To be greater in hemp compared with con (383.94+-19.3 Vs 298.60+-16.1 Mins/day, respectively). In addition, feeding duration was greater in hemp compared with con (473.8+-24.5 Vs 262.3+-31.6 Min/day). We concluded that feeding hemp to cows at the first trimester of gestation increased resting and feeding duration and did not have a deliterous effect on hemogram and serum biochemistry of pregnant cows.

ORAL & PANEL ABSTRACTS
Wednesday, August 10

10:40 AM - 11:05 AM

LIVESTOCK AND COMPANION ANIMALS/PETS SESSION 2 - ORAL/PLATFORM, FOLLOWED BY PANEL DISCUSSION

THE EFFECT OF HEMP (CANNABIS SATIVA) SUPPLEMENTATION TO THE SKIP-A-DAY FEEDING METHOD IN BROILER CHICKENS ON ANIMAL BEHAVIOR AND ANIMAL PERFORMANCE

Presenter - Nurudeen Taofeek | Daija Thompson, Patricia Sanmartin, Ethan Vroonland, Aulisea Thomas, Kiana Muse, Nautica Murrel, B. Mosley, Moyet Paris, Natalia Ceron-Romero, Judith Boateng, Simon Ogutu, Martha Verghese, Ernest Cebert, Jorge Vizcarra

The skip-a-day method is commonly used to avoid overweight and to increase flock weight uniformity in broiler breeder chickens. On a skip-a-day (sad) regime, birds are fed 2 days' worth of feed during the ""feed"" day and not fed the following day (""off-feed""). However, long-term feed restriction is perceived by some as contrary to present attitudes toward animal welfare. Therefore, there is a need to develop new feeding strategies that will address animal welfare without changing animal performance. We hypothesize that feeding spent hemp would minimize the usual ""off-feed-day"" abnormal animal behavior without changing animal performance. Chickens (n = 4/trt) in treatment group 1, were fed using the conventional sad, whereas birds in group treatment 2 were fed the conventional sad with the addition of spent hemp during the ""off-feed"" day (sad+hemp). Daily feed intake (fi) and water intake (wi) were measured for 23 consecutive days. At 4 weeks of age, animal behavior was evaluated by placing a computer and appropriate software to record birds for two hours on two consecutive days (""feed"" and ""off-feed"" day). Behaviors recorded included the number of pecks to the feeder, the number of drinking events, standing, and seating time. Animal behavior data were analyzed as a completely randomized design. There were no differences between treatments on fi, wi, and average daily gain. During the ""feed"" day, there were no differences between treatments for evaluated behaviors. However, during the ""off-feed"" day, birds in the sad treatment expended more time standing (p = 0.01), Less time seating (p = 0.01), And had fewer pecks (p = 0.06) When compared with birds in the sad+hemp. We concluded that supplementing spent hemp to the diet did not change animal performance, and animal behavior was modified during the "off-feed" day.

10:40 AM - 11:05 AM

HUMAN HEALTH AND MEDICINE SESSION 3 - ORAL/PLATFORM

CANNABINOIDS AND INHIBITION OF SARS-COV-2 REPLICATION

Presenter - Ruth Muchiri | Richard Van Breemen

Introduction: although vaccinations provide protection, breakthrough infections still occur, boosters are required, and not everyone is vaccinated. Therefore, new therapeutic agents are needed to prevent and treat infections by the severe acute respiratory syndrome coronavirus (sars-cov-2) and its variants, which cause covid-19. Sars-cov-2 vaccines induce the formation of antibodies to the spike protein, and by interfering with the binding of the spike protein s1 subunit with ace2 on the surface of host cells, antibodies can prevent cell entry and infection. We hypothesize that small molecule ligands to the spike protein s1 subunit might also prevent cell entry and sars-cov-2 infection.

Methods: an affinity selection-mass spectrometry assay was developed and validated based on magnetic microbead affinity selection screening (magmass). Magmass was then used to screen botanical extracts, including hemp extracts, for ligands to the s1 subunit of the sars-cov-2 spike protein. Botanical ligands to the s1 subunit of the spike protein were characterized using high resolution tandem mass spectrometry and identified by dereplication and comparison with authentic standards.

Results: the hemp cannabinoid acids cannabigerolic acid (cbga), cannabidiolic acid (cbda), and tetrahydrocannabinolic acid a (thca-a) were identified as ligands to the sars-cov-2 spike protein. Based on computational based modeling, cbda and thca-a bound preferentially to the orthosteric site of the spike protein whereas cbga was an orthosteric ligand. The dissociation constants (kd) for the binding of cbga and cbda to the sars-cov-2 spike protein s1 subunit were determined using equilibrium dialysis and were 19.8 +- 2.7 And 5.6 +- 2.2 &Mum, respectively. In follow-up virus neutralization assays, cbga and cbda prevented infection of human epithelial cells by a pseudovirus expressing the sars-cov-2 spike protein and prevented entry of live sars-cov-2 into cells. These cannabinoid acids were equally effective against the sars-cov-2 alpha variant b.1.1.7 And the beta variant b.1.351.

Conclusion: orally available and with a long history of safe human use, cannabinoid acids have the potential to help prevent as well as treat infections by SARS-COV-2.

ORAL & PANEL ABSTRACTS
Wednesday, August 10

11:05 AM - 11:55 AM
HUMAN HEALTH AND MEDICINE SESSION 3 - ORAL/PLATFORM
BUILDING A MORE EFFECTIVE MEDICAL CANNABIS SYSTEM
Presenter - Jordan Tishler

Imagine if your doctor told you, or your mother, or your child, that you have a serious infection. Imagine that they told you that you needed an antibiotic, but didn't tell you which one, how much to take, how to use it, or what side effects it might have. You'd be confused and feel abandoned. Frankly, that lack of guidance, and informed consent, would be considered malpractice.

Our current medical cannabis system does just that: it tells patients who are sick and vulnerable to ""just go figure it out.""
Nearly daily patients call me wondering why their medicine doesn't work, or even worse, why it's making them feel ill. Nearly every call reveals that the patients didn't get the medicine that I had recommended.
Not only does this harm patients as they desperately seek the relief they need, but the current system undermines the very trust on which a medical system must be built. Of course, the solution to this problem already exists! And it's functioning in nearly every community right now. The pharmacy system was developed to ensure the safety of patients and the reliability of medicines. Prescriptions ensure that the correct medication at the proper dosage, and with proper information is given to patients. This, in turn, boosts the credibility of the whole medical industry.

Two key ingredients form the backbone of this system: the prescription, and the prohibition of unsubstantiated medical claims. We will discuss lessons both the federal government and our industry can take away from existing systems. We will also address the lessons learned from the ""incubators of the states"" and review what a ""greatest hits"" of the states' programs might look like if implemented as national policy.

LIVESTOCK AND COMPANION ANIMALS/PETS SESSION 2 - ORAL/PLATFORM, FOLLOWED BY ORAL/PLATFORM
TRANSFER OF CANNABINOIDS COMPOUNDS FROM SPENT HEMP BIOMASS FED TO LAMBS IN ADIPOSE TISSUE AND MUSCLE
Presenter - Agung Irawan | Nathan B. Parker, Daniel G. Nosal, Richard B Van Breemen, Massimo Bionaz, Serkan Ates

Background: nutritional properties of spent hemp biomass (shb) are a good feed for ruminant animals. However, the presence of cannabinoid residues, especially delta 9-tetrahydrocannabinol (delta 9-thc), can be problematic and is the main barrier for the approval of shb as a feed ingredient by the fda-cvm. In a prior study, we detected high amounts of cannabinoids in lambs' liver fed shb. Thus, it became essential to determine the levels of cannabinoids in the most edible parts of the same animals, i.E., The meat and fat tissues. This study assessed the cannabinoid residues in adipose tissue (ap) and muscle (m) of finishing lambs fed SHB.

Methods: male polypay lambs (n=35) were randomly assigned to receive a basal diet (control), low shb (10%, dry matter [dm basis) for either 4 weeks (lh1) or 8 weeks (lh2), or high shb (20%) for either 4 or 8 weeks (hh1, hh2, respectively). Daily shb intake was recorded, and 13 cannabinoids were quantified in the ap and m sourced from the longissimus lumborum from carcass after slaughter using uhplc-ms/ms with selected reaction monitoring. Results and discussion: intakes of cannabinoids were 5.05 - 5.47 G/d for lh and 9.78 - 10.76 G/d for hh while δ9-thc was 0.06 - 0.07 G/d for lh and 0.12-0.13 G/d for hh. Our preliminary analysis detected cannabinoids in both the ap and m but, as previously observed for the liver, 4 weeks of withdrawal of shb was sufficient to eliminate these cannabinoids. The ap had higher levels of total cannabinoids compared to m (e.G., 3.6 Vs. 1.6 0X000b5g/g in the hh2 groups) but relatively less δ9-thc (2.1 Vs. 24%, Respectively). When compared liver, it accumulated <5-fold more cannabinoids compared to the ap and <10-fold more compared to the m. In all tissues, prolonged feeding of shb resulted in higher levels of cannabinoids.

Conclusion: our data clearly indicate accumulation of cannabinoid residues in the muscle and adipose tissues of lambs fed shb; however, 4 weeks of withdrawal appears to be sufficient to eliminate these residues. Our data might be useful to the fda-cvm while evaluating the approval of shb as feed for meat-type ruminants.

ORAL & PANEL ABSTRACTS
Wednesday, August 10

11:55 AM - 12:20 PM
HUMAN HEALTH AND MEDICINE SESSION 3 - ORAL/PLATFORM
CANNABINOID THERAPIES SAFETY AND ADVERSE EVENTS
Presenter - Sandra Carrillo, MD

TThis lecture is a comprehensive and thorough scientific evidence-based review and analysis of the latest literature and scientific papers published addressing the safety and potential side effects of Cannabinoid Therapies.   We will also discuss a summary of the most relevant randomized controlled trials, systematic reviews and academic documents. This is essential information for Clinicians, and Health Practitioners.

11:55 AM - 12:20 PM
LIVESTOCK AND COMPANION ANIMALS/PETS SESSION #2 - PANEL DISCUSSION

1:20 PM - 1:45 PM
BUSINESS SESSION 2 - ORAL/PLATFORM
CHEM GLOBAL CAMPUS: BOOSTING ASTEAMM™ AND LONG-TERM SUSTAINABILITY WITH HEMP
Presenter - Travell Bradford

By partnering with educational institutions, particularly historically black colleges & universities, minority-serving institutions (msi), and tribal institutions, chem global campus aims to revitalize struggling communities, invest in small business and workforce development, and establish multidisciplinary educational pipeline to success in a rapidly growing multi-billion dollar industry. Chem global campus partnerships and hubs demonstrate the opportunities to boost cannabis asteamm™ (agronomics, science, technology, engineering, model policy & medicine) in higher education, while identifying strategies for using cannabis, hemp specifically, to achieve long term economic viability and sustainability of the institutions and the communities they serve. According to mcgill university, "sustainability means meeting our own needs without compromising the ability of future generations to meet their own needs". It is not just environmentalism, but rather we find that embedded in most definitions of sustainability there are concerns for social equity and economic development. From addressing the need for more affordable housing, to combating food deserts and insecurity or repairing damage of the overpolicing and recidivism, this lecture and panel discussion session will explore how federal legalization of hemp, the 50,000+ uses of cannabis and the history of the crop in the united states create the perfect foundation to begin to address the social, economic, environmental and human injuries from nearly a hundred years of prohibition.

ORAL & PANEL ABSTRACTS
Wednesday, August 10

1:20 - 1:45 PM
QUALITY CONTROL SESSION 2 - ORAL/PLATFORM
ASSIGNING TARGET VALUES FOR UP TO 17 CANNABINOIDS IN CANNABIS PLANT AND OIL SAMPLES FOR USE IN THE NIST CANNABIS QUALITY ASSURANCE PROGRAM (CANNAQAP)
Presenter - Walter Wislon

Background: the national institute of standards and technology (nist) has developed a cannabis quality assurance program (cannaqap) to improve the comparability of the analytical measurements in cannabis testing laboratories. Cannaqap is an interlaboratory study mechanism that is similar to a proficiency testing scheme; however, the focus is towards education without assigning pass/fail grades to anonymized participants. All cannaqap studies are evaluated by nist and summarized in publicly available nist internal reports. Nist has currently completed three exercise focusing on analysis of cannabis plant and cannabis-infused oils.

Methods: samples were prepared following an ethanol extraction procedure previously approved by an expert review panel at aoac international. Subsamples ($\asymp$ 0.50 G +- 0.05 G) were extracted with 20 ml of methanol (instead of ethanol) by vortexing for 10 s, mechanically shaken for 15 min (oil) or 30 min (plant), and centrifugation for 2 min. The meoh extract was removed and for plant samples the extraction procedure was repeated. Both sample extracts were filtered through a 0.45 0X000b5m ptfe membrane filter and diluted with methanol. Samples were analyzed by a liquid chromatography method with photodiode array detection (lc-pda) using a shimadzu ""cannabis analyzer"" with a nexleaf cbx for potency c18 column (15.0 Cm x 4.6 Mm diameter, and 2.7 0X000b5m particle diameter).

Results and discussion: the lc-pda method summarized here utilized the external standard calibration method using a single absorbance wavelength of 220 nm. Baseline separation was obtained for 7 of the 11 cannabinoids resulting in two minor co-eluting pairs: (1) cbd/thcv and (2) δ9-thc/δ8-thc. Preliminary analysis was recently published by nist demonstrating its accuracy and precision using four reference hemp samples obtained from the university of kentucky proficiency testing program in 2019 and 15 commercial hemp oil samples. In the current study, the cannabinoid measurements conducted at nist are used as target values in cannaqap and will be discussed in detail.

Conclusions: in general, the nist and cannaqap participant results compare favorable for most cannabinoids, but this presentation will focus on the challenges encountered during the nist measurements such as co-elution issues, extraction methods, quantitative approaches, etc.

1:45 PM - 2:35 PM
BUSINESS SESSION 2 - PANEL DISCUSSION
CHEM GLOBAL CAMPUS: BOOSTING ASTEAMM™ AND LONG-TERM SUSTAINABILITY WITH HEMP
Presenter - Travell Bradford

By partnering with educational institutions, particularly historically black colleges & universities, minority-serving institutions (msi), and tribal institutions, chem global campus aims to revitalize struggling communities, invest in small business and workforce development, and establish multidisciplinary educational pipeline to success in a rapidly growing multi-billion dollar industry. Chem global campus partnerships and hubs demonstrate the opportunities to boost cannabis asteamm™ (agronomics, science, technology, engineering, model policy & medicine) in higher education, while identifying strategies for using cannabis, hemp specifically, to achieve long term economic viability and sustainability of the institutions and the communities they serve. According to mcgill university, "sustainability means meeting our own needs without compromising the ability of future generations to meet their own needs". It is not just environmentalism, but rather we find that embedded in most definitions of sustainability there are concerns for social equity and economic development. From addressing the need for more affordable housing, to combating food deserts and insecurity or repairing damage of the overpolicing and recidivism, this lecture and panel discussion session will explore how federal legalization of hemp, the 50,000+ uses of cannabis and the history of the crop in the united states create the perfect foundation to begin to address the social, economic, environmental and human injuries from nearly a hundred years of prohibition.

1:45 PM - 2:10 PM
QUALITY CONTROL SESSION 2 - ORAL/PLATFORM
EFFECT OF FERTILIZERS AND HARVEST TIME ON THE DEVELOPMENT OF CANNABINOIDS IN INDUSTRIAL HEMP
Presenter- Naresh Shahi | Melondria Osborne, D. Mortley

Industrial hemp (cannabis sativa l.) Has been traditionally grown for fiber and grain, but much research is currently focused on its beneficial cannabinoid properties such as cannabidiol (cbd) and delta-9 tetrahydrocannabinol (thc). Information regarding the development of cannabinoids in flowers of industrial hemp will be helpful for determining the date of thc regulatory testing, as well as the date of harvest for maximum profit. In order to help farmers maximize their profit and make informed harvest decisions, information is needed on the response of biomass yield to fertilizer and the development of cannabinoids. A plant growth chamber experiment was conducted to determine the influence of harvest intervals and fertilizer rates on changes in the thc, and cbd concentration over time in two varieties of industrial hemp, and correlate changes with stages of plant growth, and biomass yield. The experiment used a completely randomized design with a 4 x 2 factorial treatment arrangement and four replications. Treatments comprised fertilizer rates at 50, 75, 100, 125% of recommended rates and two varieties, citrus and cherry dwarf growth chamber conditions included 22 to 28ºc, 50-70% relative humidity, and photosynthetic photon flux of 160-203 0x000b5molm-2 s-1. Four to five-week-old uniform transplants of both varieties were planted into 25 cm diameter garden pots into soil in which the fertilizer treatments were thoroughly pre-mixed, and plants were watered as needed. Flower samples were collected on days 1, 3, 5, and 7 of flower initiation, and weekly thereafter until harvest (11 weeks). Flower samples were ground and thc and cbd were extracted in 95% ethanol at room temperature using ultrasound for 20 minutes and quantified using liquid chromatography-mass spectrometry. Thc and cbd content in all samples were below 0.3% And 16%, respectively, regardless of treatments and harvest times. Thc content in both varieties was less than 0.001% Up to week 3 in all treatments but increased significantly (p< 0.05) To (~0.3%) At the 125% fertilizer rate in samples harvested at weeks 8 and 9. A similar pattern was observed in cbd content of both varieties; however, cbd was detected on day 1 of harvesting (when flowers were first observed) and increased exponentially with harvest time approaching a maximum of 16% at week 10 in citrus and 14% at week 11 in cherry at the 125% fertilizer rate. The results showed that harvest times exerted a greater influence on thc and cbd than fertilizer rates. These findings could be helpful for farmers to make informed harvest decisions on the development of cannabinoids by controlling the content of thc within the government regulation threshold.

ORAL & PANEL ABSTRACTS
Wednesday, August 10

2:10 PM - 2:35 PM
QUALITY CONTROL SESSION 2 - ORAL/PLATFORM
GC-MS TERPENE ANALYSIS THROUGHOUT DRYING PROCESSES OF CHARLOTTE'S WEB PATENTED HEMP CULTIVARS CW1AS1, KIRSCHE, AND LINDOREA
Presenter - Yvonne Deporre

The story of charlotte's web surrounds a young girl with untreatable epilepsy, Charlotte Figi, and her therapeutic experience with a specific cultivar of hemp, cw1as1. This cultivar developed by the stanley brothers provided her relief from constant seizures so she could live a full life. At charlotte's web, cw1as1 and hybrid cultivars are being continuously studied to elucidate the specific attributes of the chemical profile that are responsible for its medicinal properties. Towards this goal, we aim to fully identify and understand the terpene and terpenoid profile of cw1as1 so that hybrid cultivars can be grown in diverse climates while retaining efficacy. In this study, five replicate samples from three distinct cultivars (cw1as1, kirsche, and lindorea) were harvested on october 13, 2021 in greeley, co and immediately analyzed by liquid-injection gc-ms in louisville, co. The fresh plant terpene profiles are compared, noting the differences in abundance of different classes of terpenes from different cultivars as well as differences between plants within the same cultivar. To study the drying process, additional samples from the same plants were sent through a dehydrator and air dried, separately, to compare different drying methods. This work has implications for breeding strategies targeting certain terpenes as well as the development of techniques that could be used to preserve terpenes during the harvest and manufacturing processes.

2:35 - 3:00 PM
QUALITY CONTROL SESSION 2 - ORAL/PLATFORM
NUTRITIONAL AND POTENCY CHARACTERIZATION OF HEMP AS A POSSIBLE FEED SOURCE FOR LIVESTOCK
Presenter - Jennifer Duringer | Ashley Saindon, Serkan Ates, Massimo Bionaz, Jeffrey Steiner

Currently, one of the most common uses for industrial hemp is extraction of cannabidiol (cbd)/cannabiodiolic acid (cbd-a)-phytocannabinoids which are being explored for various therapeutic uses. Once cbd/cbd-a are removed, large quantities of spent biomass remain; no standard method(s) of disposal or commercial markets for secondary product use are currently in place for hemp farmers. Preliminary nutritive value analysis of spent hemp biomass indicates that it may be a viable feed source for livestock, owing to its high-energy content. However, safety concerns exist over its chemical composition, specifically its cannabinoid content. Thus, a critical need exists for characterizing variation in the nutritive quality and cannabinoid content of industrial hemp across time, cultivation and plant dependent variables that could change these properties in the harvested plant product. In this study, five varieties of industrial hemp (cannabis sativa) were grown under two light conditions (ambient light (l1) or ambient enhanced with artificial light (l2)) and sampled after 116, 133 and 152 days in order to evaluate how biomass production and cannabinoid content varied under different light conditions and cultivation times. Total plant weight (g) and biomass production (kg dm/ha) were only affected by light condition (p<0.01); Total plant weight and biomass production in l2 was 2.4 Times greater than in l1. One variety had substantially heavier flower weight (g) than all others; flower weight was similar in both light treatments, except for one which was lower in l2 than l1. In addition, eight cannabinoids and their acids were evaluated; the concentration of cannabinoids present differed between the five varieties (p<0.05). This is consistent with studies which have shown cannabinoid potency to be strongly correlated with plant genotype. Sampling time was also shown to have an effect on potency in many of cannabinoids, but which cannabinoid was expressed most highly at which sampling time varied. This data is pivotal to the development of food safety recommendations aimed at integrating spent hemp as a livestock feed material, which will allow for reinvestment of this crop into a secondary agricultural market and create a local option for a feed source.

3:00 PM - 3:25 PM
QUALITY CONTROL SESSION #2 - PANEL DISCUSSION

POSTER ABSTRACTS
Monday, August 8

12:30 PM - 1:15 PM
POSTER SESSION A

TARGETED AND NON-TARGETED HIGH-RESOLUTION LCMS LIPIDOMIC ANALYSIS OF FAT SAMPLES FROM LAMBS FED WITH SPENT HEMP BIOMASS

Author - Jennifer Duringer | Julia Honneffer, Chloe Fender, Mackenzie Morshead, Massimo Bionaz, Serkan Ates, Manuel Garcia-Jaramillo, Jennifer M. Duringer

Oregon is a leading producer of hemp for the extraction of cannabidiol (cbd) in the united states which generates a massive amount of material known as spent hemp biomass (shb). There is significant interest in utilizing shb as a roughage source for livestock, as there are currently no standard method(s) of disposal or commercial markets for secondary product use of spent hemp once cbd is extracted. Adipose tissue is a well-known reservoir for storing cannabinoids once ingested given their lipophilic nature. To address questions around food safety and cannabinoid residues in animal tissue destined for human consumption, we evaluated cannabinoid residues and their metabolites using both targeted and non-targeted lcms analysis in samples from male polypay lambs consuming spent hemp biomass over 8 weeks divided into five feeding treatments: no shb (control) or shb at 10% (lh1) or 20% (hh1) for 4 weeks with 4 weeks withdrawal from shb, or shb at 10 (lh2) or 20% (hh2) for 8 weeks. Targeted analysis allowed for the quantification of [xyz known cannabinoids and cannabinoid metabolites] and their bioaccumulation in lambs' fat. Non-targeted lipidomic analysis revealed changes in [xyz] as the predominant lipid classes associated with cbd in the diet, with [xyz] predominantly downregulated and [xyz] upregulated in control animals when compared with lambs fed with shb. These changes were [or not] correlated with the time animals were consuming shb. Our results help define cannabinoid metabolism that is occurring within ruminant livestock species and will contribute to recommendations for guidelines on safely feeding shb to livestock.

ANALYSIS OF CANNABINOIDS IN MILK FROM COWS CONSUMING SPENT HEMP BIOMASS USING ULTRA HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY-TANDEM MASS SPECTROMETRY

Author - Daniel Nosal | Voynich Biosciences, Waimea, Agung Irawan, Massimo Bionaz, Serkan Ates, Ruth N. Muchiri, Richard Van Breemen

Introduction:
spent biomass (shb), the byproduct of cannabinoids extraction process of hemp can be fed to livestock. However, cannabinoids can potentially be absorbed by animals and residuals may appear in animal products. Therefore, a study was conducted to measure cannabinoids in cow milk post consumption of shb using uhplc-ms/ms.

Methods:
late lactating dairy cows were provided a diet of up to 13% of shb containing 3% total cannabinoids or a regular diet during a 28-day intervention period followed by 28 days of withdrawal. Milk was collected at the end of the intervention period (am and pm) and during am milking at day 3 and 28 days during the withdrawal period. Cows were dried-off at the end of the experiment and milk was collected 7 days after calving, ~60 days post intervention. Milk was prepared by protein precipitation with cold methanol containing cbd-d9 and solid phase extraction. Measurement of cbdv, cbn, cbc, δ9-thc, δ8-thc, cbd, cbg, cbda, cbga, δ9-thca-a, cbdva, cbca and cbna in milk samples was performed using a shimadzu lcms-8050 triple quadrupole mass spectrometer.

Results:
milk from cows with diets containing shb had 4.7 +- 2.0 0X000b5g/ml total cannabinoids (67% cbda and 2.7% Δ9-Thc) at the end of the intervention period, no difference between am vs pm. This corresponded to a transfer of 0.19% Total cannabinoids from hemp to milk. Milk collected on day 3 of the withdrawal period had only 1.1 +- 0.5 0X000b5g/ml total cannabinoids, a decrease of 75%. Only 0.05 +- 0.02 0X000b5g/ml total cannabinoids was detected on day 28 of the withdrawal period. Linear regression indicated 4.5 Days to eliminate cannabinoids after shb withdrawal. After calving (~100 days since withdrawal), milk contained 0.27 +- 0.11 0X000b5g/ml total cannabinoids (74% cbda and undetectable Δ9-thc), indicating that cbda accumulates in the adipose tissue and is released during post-partum adipose lipolysis.

Conclusion:
our study revealed the presence of cannabinoids in milk after shb consumption but rapid elimination once shb is withdrawn. Our data also support the accumulation of cannabinoids in the adipose tissue that is then released during early post-partum, and are found in trace amounts in milk.

DETERMINATION OF RETTED HEMP MICROBIOTA USING CULTURE- DEPENDENT AND DNA SEQUENCING METHOD

Author - Florence Okafor| Iyinoluwa Sofowora, Ernst Cebert, Ebony Weems, Qunying Yuan

The cultivation of cannabis sativa l. Has greatly increased in the us due to the lifting of the restriction on the growth and sale of hemp products. Industrial hemp has numerous industrial applications. Due to the restriction on the growth of hemp in the us, there is little research in respect to the different varieties and retting processes of the plant. The industrial application of the fiber derived from hemp is solely dependent on the retting process; a process by which micro-organisms and moisture separate the bast and woody fiber from the stem by breaking down pectin. There is a need to identify the microorganisms involved in the retting process to provide a consistent and stable supply of hemp fiber. In this study, the microbiome of hemp shoots before and after retting was determined by the culture-dependent method and dna sequencing method. Samples obtained from winfred thomas research farm were macerated in physiological saline, inoculated on culture media, and filtered in 0.22M membrane filter for dna extraction and amplification. The 16s and its gene amplicon sequencing were carried out using the illumina miseq platform. Our results revealed a cluster of genera such as azospillum, chryseobacterium, penicillium, and sodiomyces. Our results indicated that microbes present at the harvest of hemp shoot persisted after the retting process. Our study revealed that the microbes responsible for rotting (spoilage) may contribute to the retting process as they were isolated from the retted hemp shoot.

POSTER ABSTRACTS
Tuesday, August 9

12:30 PM - 1:15 PM
POSTER SESSION B

IDENTIFYING CBGA GENES IN CANNABIS SATIVA

Author - Paul Skillin| Andrea Garfinkel, Matthew Otten, Seth Crawford, Kelly Vining,

The demand for the various cannabinoid products produced by cannabis sativa has increased in recent years as legal restrictions have fallen away. One of these cannabinoids, cannabigerolic acid (cbga), is the precursor to the well-known product tetrahydrocannabinolic acid (thca), as well as cannabidiolic acid (cbda). The potential for this cannabinoid to be used in medicine has increased interest at the consumer level, thereby creating a market demand that c. Sativa breeders can develop cultivars to meet. To assist breeders to this end, we did a transcriptome analysis on a sibling population of relatively high cbga:thca ratio plants to identify genes that contribute to high levels of cbga relative to thca, which can then be used as a screening tool for breeders.

THE FEASIBILITY OF GROWING HEMP FOR FIBER IN COLORADO

Author - Abdel Berrada

Colorado has been a leader in the cultivation of hemp (cannabis sativa l.). Hemp acreage in colorado and nationwide peaked in 2019 leading to an oversupply of cbd and a substantial drop in price. Consequently, a lot less hemp was grown in 2020 and 2021 than in 2019. While cbd and other cannabinoids are still in demand, interest in other hemp products appears to be gaining momentum. For example, grain and fiber can be grown on a large scale with existing or modified farm machinery. However, for either product to be economically viable, growers must have access to good genetics, markets, and storage and processing facilities, among other things. In 2020, a project was initiated in southcentral colorado to explore the potential of growing hemp for fiber and capture a share of this market that is dominated by china. I will share the lessons learned from this project with emphasis on challenges such as varietal adaptation, retting, decortication, and fiber quality; and opportunities such as secondary uses and markets for hemp grown mostly for its stalk. I will base my recommendations for a sustainable bast and hurd hemp industry in colorado on research data, testimony from growers and others, and a review of relevant literature.

HOPPS LATENT VIROID (HPLVD) IS STABLE OUTSIDE OF CANNABIS PLANT & CAN INFECT THROUGH WATER

Author - Nathan Johnson | Sebastian Mana-Capelli, Emily Gogol, Seth Joubert

Hop latent viroid (hplvd) is a recently identified single-stranded, circular infectious rna that infects cannabis causing millions in estimated losses highlighting hplvd infection as a serious threat to cannabis growers. Common symptoms include stunted growth, reduced vigor, brittle stems, stunted flower mass, and trichomes commonly known as duding. Hplvd is thought to be spread through physical touch such as infected pruning tools or through cloning from cuttings of an infected mother. Prevention is the most effective remediation for hplvd, which requires the appropriate diagnostic tools. The current diagnostics tools available consist of a wide range of sampling techniques, detection ability, and commonly reported as a 'yes' or 'no' on whether hplvd is detected. However, there remain many remaining questions about hplvd such as 1) when to call a hplvd test positive or negative and 2) the routes of transmission. We have been studying and testing for hplvd in cannabis for over a year across the usa and have made a couple of troubling observations namely the ability for hplvd to last for weeks outside a plant, capable of transmitting through water uptake in roots, and the dynamic range of viral titers that support modifying hplvd reporting from binary to a dynamic range. To test for hplvd, we developed a robust qpcr assay capable of single molecule detection termed we-test. Validation data will be presented to demonstrate the accuracy and sensitivity of the assay. Using this assay, we have conducted testing across multiple locations, time series, and infection experiments to identify routes of transmission and longevity. Additionally, using data from over 1,000 plant samples tested across the usa as a service we can assess the dynamic range of results paired with phenotype data to identify the limits of detection based on the pathology of the hplvd infection cycle, which goes through a latent or early infection, exponential growth phase, and a highly infection density. Lastly, we propose modifying hplvd reporting from a binary report of 'yes' or 'no' to a ranking report that highlights result as non-detected, low, medium, and high viral titer account to take into consideration what stage of infection a plant may be in.

POSTER ABSTRACTS
Monday, August 8

12:30 PM - 1:15 PM
POSTER SESSION B

SURVEY OF INSECT PEST COMPLEX IN SOUTHERN OREGON OUTDOOR HEMP FIELDS

Author - Govinda Shrestha| Richard J Hilton, Tiziana Oppedisano, Silvia Rondon, Hailey Conner, Ethan Fry

Hemp (cannabis sativa l.) Is a relatively new crop in oregon and across the us. There is limited information available on which insect pests are attracted to and/or feed on hemp crops, with a potential to cause significant crop damage. Therefore, there is a need to establish baseline information for insect pest complex to establish the hemp pest management program in or. Thus, in 2021, insect surveys were conducted at weekly intervals from july to october in three to four outdoor hemp crop fields in southern or. Three monitoring tools were used to survey the insect pests: 1) yellow sticky traps for flying insects with a focus on aphids, thrips, lygus bugs, and leafhoppers, 2) beating sheet for insects feeding on hemp plants, and 3) scentry heliothis pheromone traps to monitor corn earworm moths (helicoverpa zea).

On yellow sticky traps, the total average number of thrips per trap was at the highest level (2-40 times) followed by aphids, leafhoppers, and lygus bugs. On beating sheet samples, total average aphid numbers were at the highest level (1-2 times) followed by lygus bugs, thrips, and leafhoppers. Other insect pests, such as cucumber beetles and false chinch bugs were occasionally found on beating sheet samples. Regarding leafhoppers, empoasca spp. Were caught on yellow sticky traps at the highest level followed by ceratagallia spp. And circulifer tenellus. On beating sheet samples, ceratagallia spp. Adult numbers were greater (1-2 times) than the other two species. About aphids, other aphid species numbers were greater than cannabis aphids (phorodon cannabis) on yellow sticky traps. On beating sheet samples, cannabis aphids were ten-folds higher than other aphid species. For the corn earworm survey, the number of moths collected with pheromone traps was low (0-4/trap/week) across the season, but the numbers reached peak levels in late august to early september. In summary, the survey results provide evidence that numerous insect pests can be attracted to or feed on hemp plants and warrant quantifying the level of damage by each pest type in establishing a hemp pest management program.

ALTERNATIVE WEED MANAGEMENT STRATEGIES FOR RESINOUS HEMP PRODUCTION

Author - John Jemison| Sarah Hewitt

Maine has had active hemp production since 2016. The maine hemp program staff have found weed management to be a significant challenge to growers. In 2021, we initiated a trial to compare standard black plastic production practices with the use of winter rye cover crops (mowed or rolled), cultivation, and a no-weed management control on two locations in maine. We found the mowed or rolled winter rye did not make a conducive habitat for growth. Biomass and flower production were significantly stunted, likely from the lack of tillage slowing root growth and allelochemicals possibly stunting growth. The cultivated plots and black plastic produced significantly higher biomass than any of the other treatments. This work will be repeated in 2022.

FLORAL HEMP PERFORMANCE UNDER DIFFERENTIAL IRRIGATION IN FIELD PLASTICULTURE

Author - Raul Cabrera|Eric Petit, Ariane Vasilatis, James Simon, C. Andrew Wyenandt

The performance of floral hemp cultivars was evaluated under differential irrigation in a field plasticulture system. Clonal ('baox', 'mango', 'trump t1', 'cherry wine') and seedling ('cbgenius', 'grape juice', 'triple sour', 'bay mist') cultivars were field-grown, in 2020 and 2021 seasons, in plastic-covered raised beds and fertigated with buried drip tape. Plant density was 1,400 plants/acre (6' between rows and plants). Soil moisture was tracked with tensiometers buried at 12"" and 24"", and treatments were set to initiate irrigation at target matric potentials of 25 kpa (""wet"") and 50 kpa (""dry""). Plants were fertigated weekly with a complete water soluble fertilizer (jack's 15-5-15 cal-mag) providing a total (seasonal) nitrogen application of 95 and 120 lbs./Acre (2020 and 2021, respectively). The crops were grown 15-16 weeks (mid-june to end of september) for both years.

During the 2020 season most clonal cbd cultivars had total dry weight flower yields (trimmed buds + extractable biomass) comparable or higher than the industry standard of 1,500 lbs./Acre, averaging 2,200 lbs./Acre, but only 1,075 lbs./Acre for 'trumpt1' and 'cbgenius'. The ""dry"" irrigation treatment reduced flower yields in most cultivars, by 9 to 34% with respect to the ""wet"" treatment. During the drier 2021 season (30% less rainfall than 2020) the seed-propagated cultivars averaged dry flower yields that were 38% higher than in the clonal cultivars (2,660 vs 1,920 lbs./Acre). However, the ""dry"" irrigation treatment reduced flower yields more significantly in the seedling cultivars, with average yield losses of 30% versus 16% in the clonal cultivars. Overall, these results point out strong and differential effects of drought stress on hemp flower yields.

The floral concentrations of cbd at harvest ranged 9.0 To 16% and 7 to 11% for the 2020 and 2021 seasons, respectively. The concentration of total thc exceeded the regulatory limit of 0.3% For most cultivars (more so in 'baox' and 't1trump' in 2020, averaging 0.7%, And 'triple sour' in 2021 at 0.5%). The floral cbd:thc ratios all cbd clonal cultivars in 2020 averaged 20:1, whereas they averaged 25:1 for the seed-propagated cultivars in 2021.

POSTER ABSTRACTS
Tuesday, August 9

12:30 PM - 1:15 PM
POSTER SESSION B

GENETIC BASIS FOR PRODUCTION OF THCV, A RARE AND POTENTIALLY MEDICALLY VALUABLE CANNABINOID
Author - Alisha Holloway| Erica G. Bakker

Background: tetrahydrocannabivarin (thcv) is a rare cannabinoid that has medical potential as a neuroprotectant, anti-inflammatory, and most notably as a therapeutic to improve glycemic control in type 2 diabetic patients. Thcv is a homologue of thc that differs only in the length of the alkyl side chain (3c vs 5c, respectively). Determination of alkyl side chain length depends on differences in early precursor molecules, yet the same downstream cannabinoid synthase genes are utilized for synthesis of final products. While cannabis plants can produce up to one-third of their dry weight in cannabinoids, very few produce appreciable quantities of thcv and then only up to 5-6% by dry weight. Additionally, thcv producing plants have not been improved for commercial cultivation. The goal of our work was two-fold, first to identify genes involved in the pathway for production of propyl (3c) cannabinoids, and second to develop genetic markers for use in marker-assisted breeding to develop improved high thcv cultivars.

Methods: we assessed cannabinoid content via hplc in several hundred commercially available cannabis plants that were grown in a greenhouse in hillsboro, or. We genotyped all plants with a proprietary 55k snp illumina beadarray. We initially performed nested association mapping based on 302 accessions (67 seed lots). We then performed nested association mapping on an additional 191 accessions (21 seed lots) which were selected to be homozygous alternate allele and/or heterozygous for a marker associated with propyl cannabinoids identified in the initial round of nested association mapping.

Results: we have identified two genetic markers flanking the kr/fabg1 gene in the cannabis genome which are statistically significantly associated with thcv content and were validated in additional thcv-producing germplasm. Compared to the reference genome, genotypes with alternate or heterozygous alleles at kr-associated markers are predictive of the production of thcv. However, genotype at kr-associated markers does not completely explain the variation in thcv production. Nested association mapping of propyl cannabinoids in plants that are homozygous alternate allele or heterozygous for kr-associated markers identified five additional markers which, in combination with the kr-associated markers, explain variation in propyl cannabinoid production.

Conclusions: the kr gene is a strong candidate for influencing thcv production. In arabidopsis this enzyme is integral for fatty acid biosynthesis cycles that iteratively elongate alkyl-chains by two carbon atoms per cycle. In cannabis, plastid fatty acid biosynthesis forms precursor molecules with the final alkyl chain length. In combination with kr, genes near five additional markers significantly increase propyl cannabinoid production. Marker-assisted selection in a different genetic background allowed for selection of plants with high levels of thcv.

PREVALENCE OF FUSARIUM SPECIES ASSOCIATED WITH HEMP SEED
Author - Cynthia Ocamb| William J. Thomas

Hemp is an emerging crop across the us, including in the pacific northwest. Several fusarium species are reported to cause diseases such as wilt, crown rot, stem cankers, and root rot of cannabis. Fusarium is known to be seedborne but little is known about its occurrence on hemp seeds. Studies are underway at oregon state university to evaluate the prevalence of seedborne fusarium in five different hemp lines. One hundred seed-replicates were placed onto a fusarium semi-selective medium. Two weeks later, putative fusarium isolates were transferred to carnation leaf agar and potato dextrose agar. After another 6-8 weeks, fungal isolates were identified to species based on morphological characteristics. Representative isolates were sequenced at one or more of three barcoding regions (its, ef1-alpha, and lys2) for confirmation of the fusarium species. In the first run of the study, seeds of two hemp lines were relatively free of fungi (<80% were ""clean"") and no fusarium was recovered from the seeds. Samples of the other three hemp lines had much higher seedborne fungal incidence (11-36% of seed were free of fungi) with fusarium occurrence below 5%. Aspergillus and penicillium spp. Were also recovered from hemp seeds with the latter occurring on all five hemp seed lines.
There is wide variation in fungal incidence on hemp seed lines. Fusarium can be part of the microflora associated with hemp seed along with aspergillus and penicillium and all three fungal genera can potentially occur on flower buds. All of these fungi can also potentially produce mycotoxins. Cannabis producers who utilize seed for planting should minimize levels of seedborne pathogens, and consider seedborne fungal incidence a critical measure of seed quality. The presence of pathogens on seed is often a direct route for pathogens to infect host plants. Pathogenic fusarium strains introduced to a farm field or greenhouse via infected seeds can persist in soil or plant residues for years, providing inoculum for disease development in subsequent crops. Utilization of disease management practices such as seed disinfestation as well as fungicide seed treatments for controlling seedborne fungal pathogens may optimize plant health for hemp production.

12:30 PM - 1:15 PM
POSTER SESSION B

IN PLANTA FEMALE FLOWER AGROINFILTRATION ALTERS THE CANNABINOID COMPOSITION IN INDUSTRIAL HEMP (CANNABIS SATIVA L.)
Author - Michihito Deguchi |Seema Dhir, Shobha Potlakayala, Sarwan Dhir, Wayne Curtis, Sairam Rudrabhatla

Background: industrial hemp is a diploid (2n = 20), dioecious plant and an important crop as a source of wide range of phytochemical productions. Until recently, more than 540 phytochemicals have been described. Some of them was proved to be useful for the therapy of human disease. In this study, we aimed to establish vacuum agroinfiltration method that allows the transient gene expression in hemp tissues. Afterwards, female flowers which contain abundant cannabinoids were agroinfiltrated to alter the composition of total cbd and thc.

Methods: the sequences of expressed cbdas and thcas genes were identified by rt-pcr and sanger sequence. Based on these sequences, binary vector, pearleygate 101-cbdas and pk7gwiwge(l)-csthcas rnai were constructed to increase cbda and decrease thca, respectively. After vector transformation into agrobacterium gv3101, vacuum agroinfiltration was carried out in ""crs1"" female flower. Agroinfiltrated hemp flowers were evaluated for gene expression and cannabinoid contents using qrt-pcr and hplc, respectively. Statistical analysis was performed using a 1-way anova with tukey's multiple comparison test (a=0.05).

Results and discussion: eleven copies of cbdas gene, two copies of thcas gene and one copy of cbcas gene were identified from ""crs1"" female flower. There was no non-functional copy among them. We found the functional copies of cbdas gene to be highly similar (<99% nucleotide identity). Binary vectors were constructed and agroinfiltrated to overexpress cbdas gene as well as to silence thcas gene via rna interference. The transcript level of cbdas gene was increased at more than 10 times higher than control plants which led to 54% higher total cbd content. The silencing of thcas gene was led to downregulation of thcas gene with 80% reduction in transcript levels, and total thc content was reduced to 43% of mock plant. These results suggested that hemp vacuum infiltration is highly effective for metabolic engineering of cannabinoids in hemp female flower.

Conclusions: in planta vacuum agroinfiltration in hemp female flower was useful for both gene overexpression/silencing to alter cannabinoid compositions. We are also working to establish hemp regeneration and stable transformation protocols, which will contribute to change the cannabinoid contents into desirable profiles.

WEEKLY TISSUE AND SOIL TESTING CRITERIA TO MEET THE NUTRIENT NEEDS OF HEMP GROWN FOR CANNABINOIDS
Author - Clinton Shock |Ami Gips, John Taberna

The nutrient requirements of hemp (cannabis sativa) grown for cannabinoids are poorly defined. Photoperiod sensitive hemp cultivars bred for cbd were grown on silt loam at ontario, oregon under drip irrigation in 2019, 2020, and 2021. No preplant fertilizer was applied to the field and the soil was sampled preplant and post-harvest. A table of hypothesized hemp leaf plus petiole sufficiency and a table of hypothesized hemp soil nutrient sufficiency were created based on sufficiency levels for other crops. Hemp leaves and petioles were sampled from the fourth fully expanded leaves plus petioles each week starting during the seventh week following planting and continuing for 12 weeks. Soil samples were taken at the same time as the leaf plus petiole samples. Tissue and soil samples were analyzed at western labs, parma idaho. Weekly fertilization occurred if and only if both the tissue and the soil levels were judged to be insufficient. If a nutrient was judged to be deficient, a relatively modest amount of water-soluble nutrient was applied via the drip system the same week that the tissue and soil samples were taken. As an example, hemp was planted in 2020 on 76-cm beds on 5 june 2020 and thinned to 25,500 plants per hectare. The crop received startup n through the drip irrigation, then supplemental fertilizer based on the hypothesized nutrient criteria totaling only 45 kg n/ha, 77 kg k/ha, and 0.2 Kg b/ha, all applied during the growing season. At harvest the 2020 hemp had a total dry weight biomass of 13,874 kg/ha containing 314 kg/ha of n, 51 kg/ha of p, 440 kg/ha of k, 0.45 Kg/ha of b and considerable amounts of other nutrients. Flower yield was 2982 kg/ha containing 355 kg/ha of cannabinoids. Given the results from the three years, the table of hypothesized hemp leaf plus petiole sufficiency levels provides suggestions for each nutrient to be tested on a wider basis.

POSTER ABSTRACTS
Tuesday, August 9

12:30 PM - 1:15 PM
POSTER SESSION B

A NETWORK PHARMACOLOGY-BASED STUDY ON THE MOLECULAR MECHANISMS OF THE ACTIVE INGREDIENTS OF CANNABIS SATIVA L. AGAINST MULTIDRUG RESISTANCE IN CERVICAL CANCER
Author - Innocensia Mangoato |Anastacia Shcherbakova, Motlalepula Matsabisa, Gudrun Ulrich-Merzenich

Background: there is an increasing need to develop novel adjunctive therapeutic agents against multidrug resistance (mdr) in cervical cancer from natural products due to chemoresistance in the current treatment.

Aim: to explore the potential targets and mechanisms of the active ingredients of c. Sativa l. Against mdr in cervical cancer by network pharmacology.

Methods: a network pharmacology strategy, including the construction and analysis of the drug-disease network, was used to explore the potential mechanisms of c. Sativa l. In the treatment of mdr in cervical cancer. Experimentally, caski/ddp and hela/ddp cells were developed by incremental administration of ddp in vitro. Cell viability of parental and ddp-resistant cells was evaluated using resazurin assay.

Results & discussion: a total of 1026 disease, 201 hela, 31 caski and 116 cisplatin-associated targets were identified of which 53 were drug-disease intersection targets. Ppi network analysis yielded 17 cannabinoids and 2 terpene target genes. Kegg analysis revealed that these target genes were involved in a variety of oncogenic signalling pathways while 792 go biological processes were summarized. Resistant cell lines were successfully established and ic50 values in all cell lines obtained at 24h and 48h.

Conclusion: this study using in silico network pharmacology provides a comprehensive insight into potential target genes and underlying mechanisms by which c. Sativa l. Might modulate mdr in cervical cancer.

POSTER ABSTRACTS
Wednesday, August 10

12:20 PM - 1:20 PM
POSTER SESSION C

CANNABIDIOL FOR THE TREATMENT OF IRRITABILITY AND AGGRESSION IN CHILDREN WITH AUTISM SPECTRUM DISORDER (CASCADE STUDY): SUMMARY OF 25 PARTICIPANT'S FUNCTIONAL ANALYSES OF PROBLEM BEHAVIOR

Author - Patrick Romani |Elise Sannar, Ronda Franke, Emily Werner, Nanastasia Welnick, Evangeline Adana, Steffany Contreras, Karen Regan, Patrick Romani, Crystal Natvig, Michele Adkins, Jacqueline Bainbridge, Susan Mikulich

Background:
children diagnosed with autism spectrum disorder (asd) often exhibit irritability and aggressive behavior. These problem behaviors often occur in response to routine events, such as the presentation of task demands. Preliminary data suggests that cannabidiol (cbd) may improve problem behaviors among children with asd. Thus, the cascade study was designed to evaluate the efficacy of cbd treatment for problem behavior.

Methods:
participants are children (ages 3-17) with baseline problem behaviors (comirb 19-2168, clinical trials.Gov nct04520685, fda ind 152270 exempt, funding colorado department of health & environment). Study design is a double-blinded modified cross-over with 3 arms, including 2 traditional placebo-controlled cross-over arms (12 weeks per treatment/3 week wash-out), plus a third arm where participants receive cbd for the entire 27 weeks. Randomized participants are titrated to a dose of 10mg/kg/day of cbd or placebo (provided by jazz pharmaceuticals). A secondary outcome measure is behavioral results from a functional analysis (fa) of problem behavior delivered via telehealth in participant's homes as a method to directly assess changes in child problem behavior. The fa provides a measure of problem behavior frequency and determines if behaviors occur to gain attention/preferred items or to escape from task demands. The fa occurs once before starting the study medication and two more times at the end of the first and second treatment phases.

Results:
18 participants completed all fa visits. Of these, 15/18 (83%) showed an escape function, 5/18 (28%) engaged in problem behavior to access preferred items, and 2/18 (11%) showed an attention function. Three patterns emerged as the fa repeated two more times. One participant engaged in problem behavior during only one of the fa implementations, 10 participants exhibited no problem behaviors during only one of the fa implementations, and seven participants engaged in problem behavior across all three implementations of the fa.

Conclusions:
unblinded results will help answer questions related to the efficacy of cbd in the treatment of problem behavior in asd, and help determine the efficacy of telehealth-based fa as a method of assessing behavior change in cannabidiol and other pharmaceutical trials in children with asd."

ACUTE CANNABIS USE: RETINAL FUNCTION

Author - Denise Valenti |Chris Wu

Background: acute and abstinent chronic use of marijuana impacts retinal functioning. There are reports of delayed neuroprocessing response and reduced amplitude of response with chronic but abstinent use as well as with acute use in humans. Other studies demonstrate reduced peripheral awareness, decreased recovery to glare, poor depth and stereo perception near/far with acute use. Marijuana impairs dopaminergic processing of retinal cell categories responsible for lateral interactive processing of visual functions. Measures of contrast, temporal processing and visual awareness indicate that there is dysfunction in the magnocellular processing, likely as result of dopaminergic cell dysfunctions. Dopamine is produced by retinal cells. The balance of dopamine and melatonin influence body circadian rhythms. Limited studies of animal models show potential gender differences in response to cannabis. Animal studies demonstrate retinal cell thinning with in utero exposure to cannabis as well as damage to brain movement colliculi with high dosing of individual animals. Aspects of the described findings have parallel to dysfunctions associated with impairment of dopamine processing in parkinson's disease.

Methods: using an opportunistic dosing protocol 13 adults between the ages of 21 and 40 were evaluated using a clinical test that targets retinal dopaminergic processing magnocellular pathway. The test displays seventeen targets, five degrees in size that have a temporal flip rate of 25 hz. The stripes are of variable contrast.

Results: of seventeen retinal regions tested, three regions were significantly reduced in the right eye and four in the left eye. There were trends of regional dysfunction superior/inferior indicating potential retinal circadian functional changes. There were also gender trends when looking at aggregate quadrant data.

Conclusion: retinal studies are an opportunity to better understand neuroprocessing of cannabinoids. Using functional testing visual field testing that targets the mangocellular visual pathway is an opportunity to efficiently study cannabis impairment. The instrument used does not have eyetracking. Eye movement and an inability to control fixation is a finding with chronic use as well as high dosed acute use. The lack of fixation resulted in many of the tests being invalid. Future work will utilize eyetracking to eliminate this variable.

POSTER ABSTRACTS
Wednesday, August 10

12:20 PM - 1:20 PM
POSTER SESSION C

CANNABIS FOR TREATMENT OF HUMAN SEXUAL DYSFUNCTION
Author - Jordan Tishler

Sexuality is a fundamental part of the lifecycle for most people, and difficulties can lead to loss of self-esteem, depression, anxiety, and interpersonal strife2,3. Despite its normality, half of men and nearly half of women are troubled by some form of difficulties with sexuality at some point in their life2,3. Difficulties go far beyond erectile dysfunction (ed) in men and low libido in women1,3, and arise in 4 phases: interest, arousal, orgasm, and satisfaction. Interestingly, few people ever address these issues with their care team, despite evidence that three quarters of their providers are willing and able to be helpful 7. Part of this stems from the assumption by both patients and providers that beyond the phosphodiesterase inhibitors, which work only for ed in men, there is little to be gained from therapeutics.

Cannabis therapy can provide a more effective, cross-gender solution to a broad range of these sexual difficulties. In a largely dose-dependent manner cannabis has been shown to improve function in all 4 of the domains mentioned above4,5,8. We will discuss data, clinical scenarios, and practice of treating sexual dysfunction with cannabis. We will also briefly discuss how cannabis can be used to improve sexual relations in people for whom dysfunction is not currently a problem.

CAREGIVER ATTITUDES TOWARDS CANNABIS USE FOR THEIR CHILD WITH ASD
Author - Taylor Sivori | Maclain Capron, Daniel Graves, Jill Harris, Roseann Schaaf

Background: autism spectrum disorder (asd) is the most common neurodevelopmental disorder, impacting 1 in 44 children. In recent years, the option of cannabis as a pharmacological treatment has become increasingly accessible but there is limited guidance for parents about it use. The purpose of this study is to query autistic caregivers regarding their experience, knowledge and interest in medical cannabis use for their children.

Methods: survey methodology was to query caregivers of autistic children (ages of five and ten). Informants were recruited through a large children's hospital in new jersey and through the autism speaks website. Descriptive analyses of frequencies and percentages are reported. Chi-square analysis was conducted to assess any relationship between categorical variables such as association between socio-demographic variables and survey responses. Where appliable, fisher exact tests were used to account for low counts. Data analysis was conducted through spss, version 27.

Results and discussion: surveys were sent to 4,385 informants and 568 responded. Informants were primarily white or latino, female, and received less than a bachelor's degree. The majority of participants were not familiar with cannabis use for asd although some (7.2%) Had experience providing their child with cannabis. Information about cannabis was drawn from a variety of sources. The majority of participants reported that they were willing to try cannabis for their child with asd and the top symptoms to address with cannabis use included difficulty focusing, hyperactivity, sensory sensitivities, and anxiety. Slightly less than half of those respondents were concerned about interactions between cannabis and current medications. Findings suggest a willingness among parents to use cannabis for their children with asd, but most possessed limited knowledge on the topic.

Conclusions: this study shows that caregivers of autistic children are interested in trying cannabis for their children, particularly to address specific issues such as attention, hyperactivity, sensory sensitivities, and anxiety. More studies are needed to understand the utility of cannabis for autistic individuals. It is essential that clear and reputable information about cannabis and asd is accessible.

CLINICAL TRIAL OF DAILY ORAL CANNABIS FOR CHRONIC SPINE PAIN
Author - Alan Morris | Michelle Adkins, Jacci Bainbridge, Rachael Rzasa Lynn, Emily M. Lindley

Introduction: although vaccinations provide protection, breakthrough infections still occur, boosters are required, and not everyone is vaccinated. Therefore, new therapeutic agents are needed to prevent and treat infections by the severe acute respiratory syndrome coronavirus (sars-cov-2) and its variants, which cause covid-19. Sars-cov-2 vaccines induce the formation of antibodies to the spike protein, and by interfering with the binding of the spike protein s1 subunit with ace2 on the surface of host cells, antibodies can prevent cell entry and infection. We hypothesize that small molecule ligands to the spike protein s1 subunit might also prevent cell entry and sars-cov-2 infection.

Methods: an affinity selection-mass spectrometry assay was developed and validated based on magnetic microbead affinity selection screening (magmass). Magmass was then used to screen botanical extracts, including hemp extracts, for ligands to the s1 subunit of the sars-cov-2 spike protein. Botanical ligands to the s1 subunit of the spike protein were characterized using high resolution tandem mass spectrometry and identified by dereplication and comparison with authentic standards.

Results: the hemp cannabinoid acids cannabigerolic acid (cbga), cannabidiolic acid (cbda), and tetrahydrocannabinolic acid a (thca-a) were identified as ligands to the sars-cov-2 spike protein. Based on computational based modeling, cbda and thca-a bound preferentially to the orthosteric site of the spike protein whereas cbga was an orthosteric ligand. The dissociation constants (kd) for the binding of cbga and cbda to the sars-cov-2 spike protein s1 subunit were determined using equilibrium dialysis and were 19.8 +- 2.7 And 5.6 +- 2.2 Μm, respectively. In follow-up virus neutralization assays, cbga and cbda prevented infection of human epithelial cells by a pseudovirus expressing the sars-cov-2 spike protein and prevented entry of live sars-cov-2 into cells. These cannabinoid acids were equally effective against the sars-cov-2 alpha variant b.1.1.7 And the beta variant b.1.351.

Conclusion: orally available and with a long history of safe human use, cannabinoid acids have the potential to help prevent as well as treat infections by sars-cov-2.

POSTER ABSTRACTS
Wednesday, August 10

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POSTER SESSION C

EXPLORING THE EFFECTS OF ACUTE CANNABIDIOL ADMINISTRATION ON BLOOD ALCOHOL LEVEL AND INTOXICATION IN ADULTS
Author - Patrick Gonzalez| Leila Zulic, Patrick Gonzalez, Meggan Drennan, Mark Prince, Greg Dooley, Mike Milburn, Holiis Karoly

IBackground: there has been promising research to evaluate the effectiveness of cannabidiol (cbd) as a resource for moderating alcohol consumption and dependence. However, most of these studies have been done on rodents. The present study will assess the potential impact of plant-based cbd on motor and balance impairment caused by alcohol, intoxication, and craving in humans - all important factors in determining if cbd could be helpful in alcohol use disorder (aud) treatment.

Method: recruited participants reported heavy drinking and no recent or regular cannabis use. Participants completed 3 sessions in which they were randomly assigned to consume either 30 mg cbd, 200 mg cbd or placebo cbd prior to drinking a standardized dose of alcohol. The standardized dose of alcohol resulted in approximately .06G/dl blood alcohol content (bac). An hour after consuming the alcohol, breath alcohol content (brac) was recorded and tasks to measure impairment and questionnaires centered around mood and cravings were administered every 30-minutes for 3.5 Hours. Blood was drawn at baseline, time of peak cbd, and time of peak bac.

Results: data collection for this project has just been completed. Preliminary analyses suggest that at peak brac, psychomotor performance is worst for the placebo condition, followed by 200 mg cbd, and best for 30 mg cbd (p=.038). We will also explore differences in measures of alcohol urge/craving, positive and negative affect, and psychomotor impairment across cbd conditions, as well as sex differences in these outcomes.

Discussion: the findings from the present study will further our understanding of the role that cbd may have in moderating alcohol craving and impairment in humans. These results will also give insight into the relationship between the endocannabinoid system and alcohol consumption which has potential implications for cbd as an aud treatment.

IN-VITRO ASSESSMENT OF THE PHYSIOCHEMICAL AND ANTIBACTERIAL PROPERTIES OF TWO NORTHERN ALABAMA GROWN CBD HEMP (CANNABIS SATIVA L) CULTIVARS
Author - Aaron Dudley | Iamin Kassama, Armitra Jackson-Davis, Ernest Cebert, Xianyan Kuang

Background: plants are an excellent source of bioactive components. Specifically, medicinal plants are gaining significant attention globally due to their natural antimicrobial and antioxidant benefits to human health. In this context, special attention should be given to hemp (cannabis sativa l) due to its known antibacterial and antioxidative properties. However, the bioactivity of cultivars grown in northern alabama and their implication for food safety and quality is understudied. Thus, the objective of this study was to evaluate the antibacterial and antioxidative potential of two northern alabama hemp cultivars cbd 5 and 17 as a whole (w) and defatted (df) macerated ethanolic extracts (96% ethanol).

Methods: in this study, hemp inflorescences were used, whole samples were ground (<=6000x000b5m), defatted samples were obtained by soxhlet extraction. The physiochemical evaluation consisted of proximate analysis and color determination (d/8 portable colorimeter, hunterlabs-reston, va), and the antioxidant potential of extracts was determined by dpph free radical scavenging activity (2,2-diphenyl-1- picrylhydrazyl). Antibacterial activity against cocktails of enteric pathogens listeria monocytogenese (lm) and salmonella enterica (se) was evaluated using a bioscreen-c microtiter. Data was expressed, in triplicate, as mean +- standard deviation (n = 9). Statistical significance was evaluated by anova, p<=0.05 Was considered significant.

Results and discussion: colorimetric values between cultivars in the a* color space showed significant differences (p <= 0.05). Radical scavenging activity results indicated significant differences within cultivars (p = 0.0085) And processing (p = 0.001) With cbd 17 df having the highest rsa (70.51 +- 4.24%) Compared to the positive control of ascorbic acid (83.81 +- 5.85%). Antibacterial results indicated that hemp extracts had a significantly lower optical density at the end of the 24-hour observation period compared to the negative controls (p <= 0.05) And significant interaction between cultivar and processing (p <= 0.05).

Conclusions: northern alabama cultivars of hemp extract can be utilized for the enhancement of the safety and quality of food. Future research will focus on incorporating northern alabama cultivars of hemp into an active nanofibrous film which will contribute immensely to food preservation and global food supply chain sustainability.

POSTER ABSTRACTS
Wednesday, August 10

12:20 PM - 1:20 PM
POSTER SESSION C

ORAL ADMINISTRATION OF CANNABIS RESULTS IN CHANGES TO THE METABOLOME, NEUROCHEMICALS, AND ENDOCANNABINOIDS OF MICE

Author - Nichole Reisdorph | Katrina Doenges, Cassandra Levens, Jon Manke, Michael Armstrong, Kevin Quinn, Kristine Kuhn, Rick Reisdorph

Background: the legal use of cannabis has expanded worldwide; however, critical research to understand health effects has not kept pace. For example, studies focusing on oral consumption of cannabis and thc-containing products, i.E. ""Edibles"", have only been conducted to a limited degree. In addition, the effects of thc and cannabis on neurochemicals and other small molecules related to health are still largely unknown. We have conducted an initial study in mice to determine the effects of oral consumption of whole cannabis and a complex cannabis extract on the metabolome, neurochemicals, and endocannabinoids.

Methods: mice (c57bl/6 wt) were given no, low, medium, or high doses of either a crude cannabis extract via gavage, purified cbd/thc by intraperitoneal (i.P.) Injection, or whole cannabis mixed with nutritional gel over 2 weeks. In addition to discovery-based metabolomics, quantitative mass spectrometry was used to measure 25 neurochemicals, 13 endocannabinoids, and thc/cbd in brain and plasma at study end. Both anova and t-tests were used to conduct statistical comparisons, with false discovery rates applied.

Results: changes in the metabolomes of mice from all treatment groups were noted, with the majority of differences seen in plant-related compounds such as 6-benzylaminopurine, n-decanoylglycine, and 4-p-coumaroylquinic. Differences were found between neurochemicals in the brains and plasma of animals treated by gavage (e.G., Phenylalanine, tryptophan $p < 0.05$) And in mice receiving whole cannabis (e.G., Dopac and trp, $p<0.05$). Trp was down in all animals receiving cannabis or purified cbd/thc, regardless of dose. Levels of the endocannabinoid, 2-ag were decreased in gavage mice receiving lowest doses, but were higher in mice receiving highest doses compared to controls (anova $p < 0.05$). Both cbd and thc were quantified in the plasma of all animals receiving the complex cannabis extract by oral gavage and in brains of the majority of animals receiving higher doses. Thc was only detected in brain and plasma when animals were free-fed cannabis at the high dose.

Conclusions: following treatment of mice with cannabis or purified thc/cbd, changes in both the metabolome and to specific neurochemicals and endocannabinoids were noted, although not always in a dose dependent manner.

PERI-EXERCISE CANNABIS USE IN ACTIVE ADULT ATHLETES

Author - Joanna Zeiger | William S. Silvers , Robert S. Zeiger

Background: the athlete peace (pain, exercise, and cannabis experience) survey sought to understand the prevalence and patterns of use in active, adult athletes aged 21-70+, including before and after exercise (peri-exercise).

Methods: 1,161 (91.1%) Of the 1,274 athletes taking the survey completed it. Current cannabis use was evaluated by asking ""in the past two weeks, have you used marijuana (including thc and/or cbd)?"" The 301 participants (26%) who indicated past 2-week cannabis use were asked if they used it 1-hour pre-exercise (pre) and/or 1-hour post-exercise (post) and to choose as many of the 8 reasons why they used it during peri-exercise. Chi-square determined if any of the reasons for use were associated with demographics or athletic benefits and/or success.

Results and discussion: 134 participants (44.5% Of cannabis users) used peri-exercise cannabis, 79 (26%) used it pre and 100 (33%) used it post. Reasons for use were: improves activity enjoyment (68.4% Pre, 28% post), improves focus (70% pre, 32% post), pain management (57% pre, 83% post), enhances performance (49% pre, 34% post), aids recovery (16% pre, 85% post), relaxation (39% pre, 76% post), increases energy (54% pre, 36% post), and aids sleep (23% pre, 79% post). Significant differences were observed for pre reasons for use by subjective performance benefits: improves focus, $p<0.001$; Improves activity enjoyment, $p<0.01$; Enhances performance, $p<0.001$; And increases energy, $p<0.001$. Additionally, there were significant differences for pre use by cannabinoid used: pain management, $p<0.01$; Improves focus, $p<0.05$; And improves enjoyment, $p<0.001$. There were significant differences for post reasons for use by cannabinoid used and subjective performance benefits: improves focus, both $p<0.001$; Improves activity enjoyment, both $p<0.001$; Increases energy, $p<0.05$ & $P<0.001$, Respectively. Additionally, post-use subjective performance benefits were associated with pain management, $p<0.05$ And aids sleep, $p<0.01$. There were no significant differences in reasons for peri-exercise use by number of days of exercise per week, age, gender, level of athlete (pro, amateur, competitive, recreational), and placement in races.

Conclusions: subjective perception of exercise benefits and cannabinoids used were observed with peri-exercise cannabis use. Objective measures of exercise improvement need to be explored further.

POSTER ABSTRACTS
Wednesday, August 10

RADICLE ACES: A RANDOMIZED, OPEN-LABEL TRIAL OF COMMERCIALLY AVAILABLE CBD PRODUCTS USED IN A REAL-WORLD SETTING
Author - Jeff Chen | Jessica Saleska

Despite the massive and growing market for cannabinoid products, there is scant data on the safety and effectiveness of these products. Lack of federal research funding and the inefficiencies of traditional research have hindered the generation of large-scale, high-quality clinical trials on cannabinoids.

Methods: radicle aces (advancing cbd education & science), the largest clinical trial of cbd to date, was a four-week, irb approved, open-label, randomized controlled trial to evaluate the safety and effectiveness of commercially-available cbd products. Participants (n=2820) were rapidly recruited from across the united states via the radicle science virtual platform and assigned to one of 13 commercially available cbd products or a waitlist control.

Well-being and anxiety, sleep difficulty and pain symptoms were measured every week via online surveys using validated health indices. The health scores of each product group were compared to that of waitlist control using linear mixed models. Product characteristics (cbd dose per serving, cbd spectrum) were also compared using post-hoc analyses.

Results & discussion: significant improvements in well-being, anxiety, sleep difficulty and pain were observed in every product group relative to waitlist control. Across all health outcomes, the largest improvements were observed within the first week. Other key findings include:

Conclusions: radicle aces has delivered much-needed clarity to a confusing marketplace where consumers are baffled and brands have few opportunities to differentiate themselves through rigorous clinical data. Radicle science has re-imagined clinical trials resulting in cheaper, faster, and larger studies that can finally prove or predict which health and wellness products to use for a desired effect, benefiting consumers, healthcare providers and brands. The anonymized aggregate results of the study will be published in a peer-reviewed journal in mid-2022.

RESIDUAL EFFECTS OF CANNABIS ON SIMULATED DRIVING PERFORMANCE FOLLOWING SHORT PERIODS OF ABSTINENCE
Author - Kyle Mastropietro | Anya Umlauf, David J. Grelotti, Robert L. Fitzgerald, Igor Grant, Thomas D. Marcotte

Background: during abstinence, some heavy cannabis users may display residual cognitive effects which typically resolve within 30 days. It is largely unexplored whether residual effects are seen in everyday behaviors, including driving, with dahlgren et al. (2020) Finding that a subset of users displayed reductions in driving simulator performance during a short abstinence period while brooks-russell et al. (2021) Found users performed better than non-users on a simulation. The current study examined whether non-acute, short-term residual effects of cannabis are seen in driving simulator performance during brief periods of abstinence, and whether any deficits are related to use intensity or demographic factors.

Methods: 191 cannabis consumers with varying use histories completed a 25-minute drive on a high-fidelity driving simulator following < 48 hours of abstinence. The simulation included both urban and rural driving segments, and focused traffic challenges (e.G., Crash avoidance). The primary outcome was the composite drive score (cds), a global measure of driving performance comprising key subtests: standard deviation of lateral position (sdlp), divided attention, and car following (marcotte et al., 2022). Bivariate correlation analyses were conducted to assess the relationships among the cds, its subtests, and cannabis use intensity and demographic variables.

Results and discussion: participants were abstinent for an average of 5.35 Days, with heavier use intensity over the previous six months predicting shorter abstinence periods (r = -.17, P = .035). Cds was unrelated to indicators of past use, including use intensity over the previous six months, abstinence period, whole blood thc concentration, and age of use onset, and demographic variables (all ps < .10). The subtests comprising the cds (e.G., Sdlp and car following) were also unrelated to indicators of past use and demographic variables (all ps < .10).

Conclusions: as the largest study of its kind to date, the current study did not find evidence of a dose-effect relationship between cannabis use and decrements in simulated driving performance during short periods of abstinence, suggesting that the short-term residual cognitive effects of cannabis might not translate directly to decrements in some overlearned behaviors, such as driving. Future studies should include a non-using comparison group.

12:20 PM - 1:20 PM
POSTER SESSION C

SEXUAL DIMORPHISM IN THE USE AND EFFECTIVENESS OF CANNABINOID-BASED MEDICINES FOR CHRONIC PAIN
Author - Charlotte Bastin| Lucile Rapin, Maria Fernanda Arboleda, Erin Prosk, Alain Watier, Michael Dworkind

Background: the lack of sex-related reporting in the current literature on cannabinoid-based medicines (cbm) limit the generalization of clinical recommendations; however, as cbm use has become more common in clinical settings, real-world evidence can provide valuable insight to guide future rcts and inform clinical practice - especially in chronic pain management, the most common clinical use of cbm worldwide. The aim of this study is to compare use and effectiveness of cbms to treat chronic pain and associated symptoms in dorsopathies in male and female patients.

Methods: participants are consenting adult patients diagnosed with dorsopathies (icd-10 cm code m50-54) and treated with adjunct cbm between july 14th, 2020 and october 31st, 2021 at a network of clinics in québec, canada. Complete medical and cannabis use history is documented at baseline; effectiveness is assessed via the revised edmonton symptom assessment system (esas-r) at baseline and 3-month follow-up (fup3m). Each esas-r item is assessed using mixed anova with 2 between factors (sex and baseline cannabinoid profile: cbd-dominant, thc:cbd 1:1, thc-dominant), 1 within factor (visit). Previous cannabis use and cbm recommendations are assessed with chi-square test. P-value is set at 0.05.

Results and discussion: among 367 patients, cbm recommendations significantly differ at baseline between sexes, where cbd-dominant products are more frequently authorized for females and thc:cbd 1:1 and thc-dominant are more frequent in males. Pain, wellbeing and fatigue scores significantly improved from baseline to fup3m independently from sex or cannabinoid profile. Moreover, females report worse overall scores in fatigue and wellbeing, report more adverse events, and are more frequently cannabis-naive than males. The latter could explain the rates of adverse events and cbd-dominant profile recommendations.

Conclusions: this study provides preliminary indication that cbm recommendations, adverse events and previous cannabis use differ by sex, and that with different baseline treatment plans, patients of both sexes report similar improvement on pain, fatigue and wellbeing results are novel considering the current lack of sex-related reporting and require further investigation among larger patient populations in controlled clinical settings to assessing confounding factors and to clarify the sexual dimorphism in cbm treatment recommendations and therapeutic effects.

SURVEY OF ADULT MEDICINAL CANNABIS USE
Author - Barbara Brett | Stanley Eaton, Brittany Siciliano, Kristen Wolf, Atzin Martinez, Chloe Foust

Thirty-seven states have opted to regulate cannabis for medicinal use by qualifying individuals. Unfortunately, information about medical cannabis users is limited. The goal of this study was to collect information about what medical conditions people are treating with cannabis, what types of products they are using, and what are the perceived effects of cannabis on symptoms. We developed a 54 question survey that was administered both online and in-person along with two standardized tests - the promis global-10 score (promis) and the liverpool adverse events profile (laep). Thirteen adult medical marijuana users participated in this study. 53.8% Were treating the qualifying condition of severe pain, while 38% were treating persistent muscle spasms. 69.2% Of our sample was also treating non-qualifying conditions, for example, sleep/insomnia. 53.8% Were also treating each of the following: anxiety, stress, and chronic pain. 61.5% Of our sample reported most commonly smoking cannabis flower. 61.5% Reported using cannabis 1 - 4 times per day. 30.8% Reported most commonly using indica/sativa hybrids. On a scale of 1 - 5 (not manageable at all to manageable), 100% of participants said the manageability of their symptoms was at a 3 or less before using cannabis and 100% said it was at a 4 or higher after using cannabis. Data from the laep showed people experienced a relatively low level of adverse events related to cannabis use that were considered always or sometimes a problem (mean = 17.46 +- 12.54Sd). Data from the promis showed the general physical and mental health of participants was "fair" compared to the general population (mean physical health t(12) = 41.65 +- 4.3Se; mean mental health = t(12) = 43.69 +- 3.67Se). This data demonstrates the following: people are using medical cannabis to treat not only qualifying conditions but also conditions that are beyond the scope of qualifying conditions for most states; people perceive positive effects of medical cannabis use on symptoms and limited adverse events; and, people using medical cannabis are in fair health compared to the general population. Preliminary urinalysis results will also be discussed. This study was approved by the csu-pueblo irb.

POSTER ABSTRACTS
Wednesday, August 10

12:20 PM - 1:20 PM
POSTER SESSION C

THE SEARCH FOR THE KEY TO CANNABIS
Author - Hans Peruke I| Harald (h.g.j.) Van Mil, Young Hae Choi, Hans Perukel

Background: the Netherlands was one of the first counties to legalize the personal use of cannabis and is a leading country in agricultural innovation, but due to the complex legislation, cannabis production and innovation has not risen to its full potential. Anticipating the legalization of cannabis production, the adriaan van royen institute started a project to accelerate the innovation in cannabis production, research and dissemination for consumers and cultivators. One of the activities is development a framework, based on diverse scientific methods, to link cannabis chemical profiles of specific cultivars to panel sensory experiences in both controlled and semi-controlled designs in combination with consumers' feedback. Here we present the pilot study on a semi-controlled test design.

Methods: a questionnaire is designed to collect demographic data and sensory responses of an untrained test panels and integrated in a dedicated mobile app and database (budlerz, high service). Dutch costumers are selected based on age and gender and asked to participate in a consumer experiment. The participant is provided with a blind cannabis sample, a vaporizer (the mighty, storz and bickel) and the questionnaires app in a semi-controlled environment. The sample are analyzed using gas-(gc) and high performance liquid chromatography (hplc). The chemical and sensory data are analyzed using unsupervised and supervised machine learning methods. Sensory data are linked to observed clusters and used as a supervising variable in supervised methods.

Results: sensory variable levels, like muscle relaxation and alertness, are enriched in clusters and show significate correlations to the chemical profiles of samples obtained from gc and hplc. More complex sensory variables suffered from a lack of consensus on sensory semantics.
First results are promising for most of the sensory data, other sensory items need to be redesigned due to the lack of panellist consensus. The workflow and general study design however, works and allow for scaling to greater untrained panels and number of cultivars.

Conclusions: the results fit well in a greater framework of measurements under controlled conditions and general consumers feedback. The current setup for the untrained panels, however need some adaption of the questionnaires but already shows reproducible results.

ASSESSMENT OF HEMP (CANNABIS SATIVA L.) CULTIVARS FOR ANTIOXIDANT CONTENT AND ANTINUTRIENT FACTORS
Author - Ogechukwu Tasie | Judith Boateng, Ernst Cebert, Xianyan Kuang

Hemp seeds are the edible fruit of the cannabis sativa l. Plant, and an excellent source of proteins, minerals, and vitamins, however, the presence of antinutritional factors (anfs) prevents its bioavailability. Hemp also contains phytochemicals that confer health benefits. Various cultivars have different concentrations of phytochemicals and anfs, and thus, there is a need to screen the cultivars to select the appropriate ones for further analysis. Thus, the objective of this study was to evaluate the antioxidant content and anfs of twelve cultivars (altair, anka, international hemp, cfx-1, cfx-2, hemp grandi, hemp henola, rohrer hlesiia, rohrer hiliana, rohrer h51, lara, and uni seeds vega) of industrial hemp seeds collected from the alabama a&m winifred thompson experimental station, hazel green alabama. Phenolic and flavonoid content was determined using a reversed-phase high-performance liquid chromatography ultraviolet (rp-hplc-uv) system. Analysis of variance was employed to analyze data and means were separated by tukey's test. Experiments were conducted in triplicates, and $p<0.05$ Was regarded as significant. The results showed that the hemp variety, uni seeds vega, had the highest tpc of 121.605 Mg gae 100 g-1 dw and the highest tfc (86.405 Mg ce 100 g-1 dm) for the defatted hemp seed cultivars, while the cfx-1, had the lowest tpc of 42.722 Mg gae 100 g-1 dm for the non-defatted hemp seed cultivars. The highest antioxidant capacity (frap 0x000b5mol fe (ii) so4 100 g-1dw) was observed for the uni seeds vega at 913.31 0X000b5mol fe (ii) so4 100 g-1dw, and the lowest frap observed for the hemp variety, hemp gen. Int. Grandi at 385.62 0X000b5mol fe (ii) so4 100 g-1dw. The altair had the highest tfc and frap content in non-defatted hemp seed cultivars. Saponin was the most abundant anfs in hemp seeds. Chromatographic investigation showed the presence of polyphenol and other compounds in hemp. This study showed hemp as an excellent source of flavonoids and phenolic compounds.,

12:20 PM - 1:20 PM
POSTER SESSION C

TOLERABILITY AND EFFICACY OF CANNABIDIOL ON MOTOR SYMPTOMS IN PARKINSON DISEASE

Author - Ying Liu| Stefan Sillau, Sarah Rajkovic, Michelle Adkins, Jost Klawitter, Cristina Sempio, Michelle Fullard, Trevor Hawkins, Lauren Seeberger, Emil Diguilio, David Vu, Sarah Baker, Tristan Seawalt, Department of Neurology, Grace Chin, Heike Newman, Jacquelyn Bainbridge, Maureen Leehey Department of Neurology, University of Colorado Anschutz Medical Campus"

Introduction: cannabis use is frequent in parkinson disease (pd), despite limited data regarding its effects. This study examined the efficacy and tolerability of relatively high cannabidiol (cbd) and low 9-d-tetrahydrocannabinol (thc) in pd.

Methods: in this double-blind, controlled, parallel study participants took cannabis extract (from national institute of drug abuse) oral sesame oil solution with 100mg/ml cbd and 3.33Mg/ml thc, starting at 1.25Mg/kg/day and increased to 2.5Mg/kg/day for 10-14 days.

Results: between 09/2018 and 01/2022, 74 persons enrolled, and 60 (68% men) completed the study: mean (sd) age 69.53+-6.95, Disease duration 5.72+-5.71 Years. Thirty participants were randomized each to active study drug and placebo, matched in age, sex and stage of disease. Mean final dose was 185.8 +-56.7Mg cbd and 6.2+-1.9Mg thc per day, in two divided doses, in the cbd group.

At the 1.25Mg/kg/day dose, the change of motor and total mds-updrs scores from baseline was -3.8 (P=0.0032) And -7.9 (P=0.0003), Respectively, in cbd group, and -2.5 (P=0.0236) And -5.3 (P=0.0011) In the placebo group; the differences between the two groups were not significant (-1.3, P=0.4057; -2.7, P=0.2758). At the 2.5Mg/kg/day dose, the change of scores was -4.7 (P=0.0123) And -6.8 (P=0.0149) In cbd group, and -2.6 (P=0.0252) And -7.1 (P=0.0003) In placebo group. Again, the differences between the two groups were not significant (-2.1, P=0.3223; 0.3, P=0.9213).

The plasma level of cbd was 52.0+-32.8 And thc was 1.0+-0.9 Ng/ml on 2.5Mg/kg/day of active study drug for 14 days.

The cbd group reported aes 278 times (2 saes); 84% reported an ae: including dizziness (58%), feeling of relaxation (42%), fatigue and decreased concentration (32%), headache (29%), somnolence and feeling abnormal (26%), and feeling drunk (23%). The placebo group reported aes 139 times; 83% reported an ae: including headache (33%), somnolence (27%), feeling of relaxation (23%), dizziness and fatigue (20%). Most aes were mild; one participant withdrew due to intolerance.

Conclusion: both the cbd and placebo group experienced significant improvements on motor and total mds-updrs scores, with no significant difference between the two groups. Strong placebo effects occurred. Relatively high cbd/low thc was tolerated in pd, with many mild aes.

TARGETING CANNABIS EDUCATION

Author - Daniel Bear | Ashley Hosker-Field, Marilyn Creswell

Background: effectively engaging young-adult cannabis consumers with harm reduction and benefit maximization information is an important component of reducing potential negative outcomes associated with cannabis consumption. Previous public education efforts have had limited success changing behaviours, and often use stigmatizing language that may lower young people's trust in the messaging. In partnership with canadian students for sensible drug policy and the canadian public health association, we sought to build a new cannabis public education campaign based on data gathered from young adult cannabis consumers.

Methods: as part of a mixed methods approach, we conducted two series of focus groups (15 in total) with canadian cannabis consumers aged 18-30, cannabis retail employees, and drugs policy experts, in order to identify who cannabis consumers trust to deliver cannabis information, what language or tone turns reduces their trust in cannabis education campaigns, and what information they seek from public education initiatives. Nine focus groups took place in the first round, and explored past cannabis education campaigns and materials. We used that data to build two draft cannabis education campaigns, and conducted another six focus groups to see how consumers reacted to the new campaign ideas.

Results and discussion: respondents identified a conflicted but overall positive relationship with health professionals and academics, and lower overall trust in employees or representatives of for-profit cannabis companies. Advertisements and infographics with clear, usable information were preferred over more generic messaging, and the inclusion of citations were seen to improve validity of educational materials. Association with anti-drugs groups undermined the impact of educational campaigns, as did stigmatizing language.

Conclusions: our results highlight the need to target drugs education campaigns to the self-professed needs of drugs users, and to ensure that language in such campaigns is carefully considered to avoid the inadvertent use of stigmatizing language or depictions. Future campaigns may benefit from a human-centred-design approach that focuses on how to have the best outcomes when consuming cannabis, not simply demand reduction goals.
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