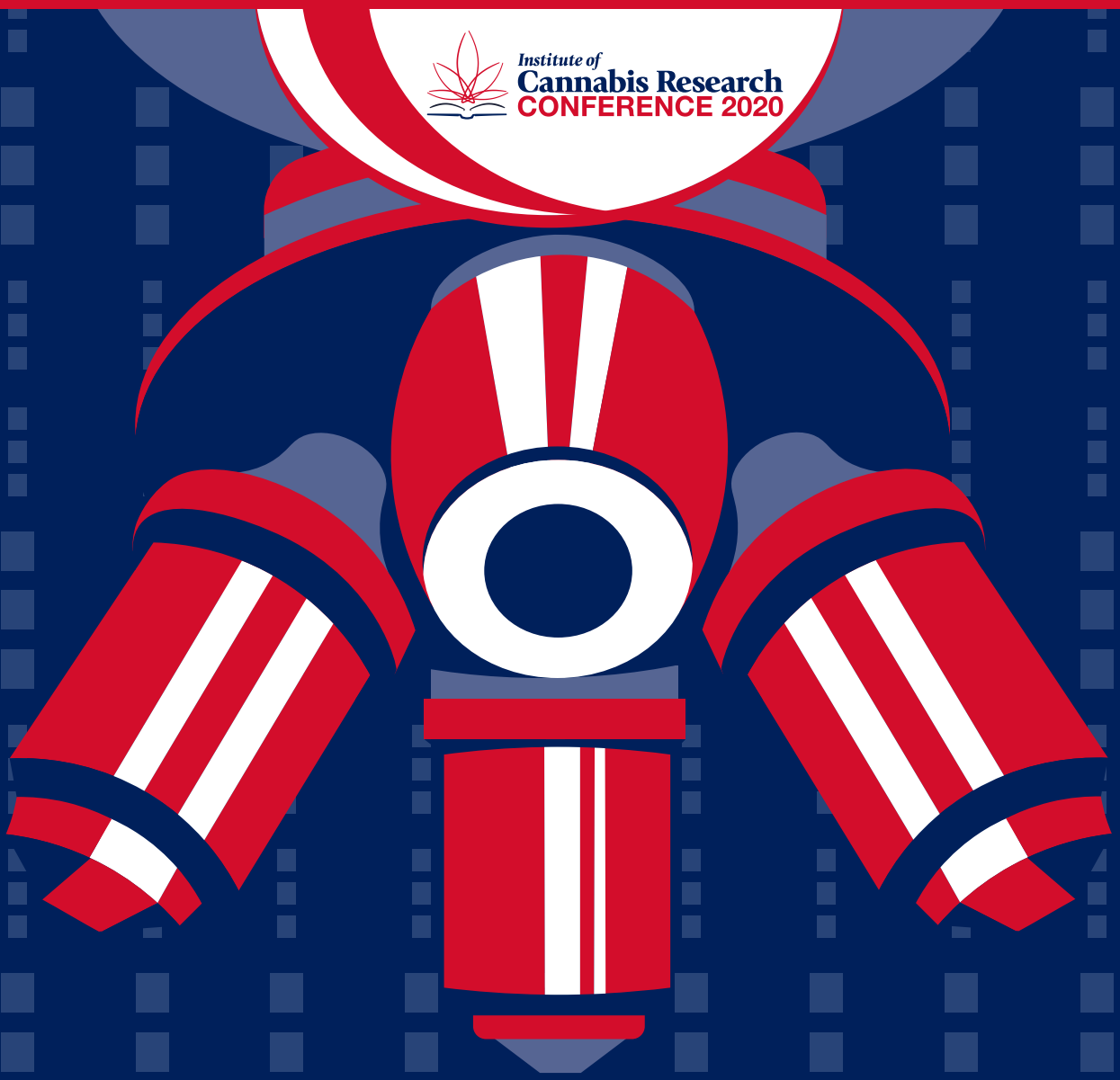
August 11-12, 2020




# ADVANCING CANNABIS APPLICATIONS

Institute of Cannabis Research
CONFERENCE 2020

# The ICR would like to thank the Exhibitors and Sponsors that helped make the ICR Conference 2020 a success.

# Mechoulam Speaker

**Dr. Roger Pertwee** delivered the Mechoulam Lecture at the Institute of Cannabis Research – 2020 Conference. Dr. Pertwee was personally recommended by Dr. Raphael Mechoulam for this honor.

**Pharmacological Actions and Potential Novel Therapeutic Uses of Some Plant and Synthetic Cannabinoids**

Cannabis is a source of at least 120 compounds collectively known as phytocannabinoids. Of these, only two have so far been approved for clinical use: Δ9-tetrahydrocannabinol (THC; Marinol®) as an anti-emetic, cannabidiol (CBD; Epidiolex®) for treating childhood epilepsy, and THC plus CBD (Sativex®) for ameliorating multiple sclerosis. I will review evidence (1) that CBD and three other non-psychoactive phytocannabinoids, cannabidiolic acid (CBDA), cannabigerol (CBG) and Δ9-tetrahydrocannabivarin (THCV), possess pharmacological properties of potentially important therapeutic relevance, and (2) that a synthetic CBDA analogue, HU-580, is more "druggable" than CBDA. More specifically, (1) CBD, CBDA and HU-580 appear to act via 5-HT1A receptors to ameliorate anxiety and chemotherapy-induced nausea and vomiting, (2) CBG can induce α2-adenoceptor-mediated pain relief and (3) THCV is a CB1 cannabinoid receptor antagonist and CB2 cannabinoid receptor agonist, and may therefore, ameliorate disorders such as diabetic renal nephropathy and nicotine dependence. There is evidence too that THCV might induce 5-HT1A receptor-mediated amelioration of schizophrenia. In addition to HU-580, just one other example of a novel synthetic phytocannabinoid is a water soluble "THC prodrug"; this also has therapeutic potential as it ameliorates signs of glaucoma, at least in rabbits. Cannabinoid receptors are activated not only by phytocannabinoids such as THC, but also by chemicals known as endocannabinoids that are produced and released, for example, by human neurons. Endocannabinoids play an "autoprotective" role in various disorders, raising the possibility that enhancing their activation of cannabinoid CB1 and/or CB2 receptors might be therapeutically beneficial. I will review evidence that administering a CB1 positive allosteric modulator (PAM) that strengthens CB1 receptor activation by targeting a CB1 allosteric site, can suppress signs of inflammatory and neuropathic pain in mice without producing signs of tolerance or dependence. Additionally, I shall present quite recent evidence that there is also an allosteric site on the CB2 receptor, and that a novel positive allosteric modulator of this site displays anti-cancer properties.

# Keynote Speaker

**Dr. Jeffrey Steiner** delivered the Opening Plenary at 8:30 am on August 11. Dr. Steiner is the Associate Director of Oregon State University's Global Hemp Innovation Center.

**Unlocking a Dusty Time Capsule: Shaking out Hemp Genetics, Geography, Sector Composition, and Equity**

Hemp, a new-old crop, has missed out on 80 years of discovery and innovation that have propelled agricultural productivity to this point in time when more food, feed, and fiber are produced for so many, by so few, than ever before. The efficiencies by which agricultural-based products are produced are staggering compared to early in the last century, but with these increases have come additional economic, environmental, and social challenges to the long-term sustainability of farms, communities, and the planet. The potential for hemp is widely touted as a solution to improve health outcomes, provide new renewable products, and expand economic development, but what does that really mean? This presentation reviews the status of hemp as an emergent commodity finding its way into existing agricultural landscapes and markets, and provides perspectives on its possibilities for the future and what is needed to get there.

# Pre-Conference Workshop

For the first time, the ICR 2020 conference offered pre-conference workshops.

**Workshop 1: Workers' Rights in Cannabis Spaces**

- Part 1: targeted at individuals employed in the cannabis industry, or wish to obtain employment in the industry and desire to learn about practices of occupational health and safety and labor rights in the cannabis sector.
- Part 2: targeted at traditional conference attendee audience members: academics, non-academics, business representatives and members of the general public with a desire to learn about practices of and research pertaining to occupational health and safety and labor rights in the cannabis sector.
- Course presenters and facilitators would be representatives from **CO Department of Agriculture** (worker pesticide issues), OSHA (rules and regulations pertaining to health and safety), an occupational health consultant (regulatory issues pertaining to compliance), and trade union representative (labor rights and labor union issues).

**Workshop 2: Cannabis Policy and Medical Case Study**

- **Lost in the Weeds: The Past, Present, and Potential Future of Hemp in Medicine - Stephen Ziegler, PhD, JD**: Marijuana (MJ) and hemp are genetically distinct cousins of the genus Cannabis sativa L., yet they have been erroneously associated with each other for the past 80 years. That all changed in December 2018 when Congress removed hemp from the federal Controlled Substances Act (CSA) and legalized the plant and its derivatives such as Cannabidiol (CBD), a substance that has received a great deal of attention for its potential to treat a variety of medical conditions. In an effort to inform stakeholders about this rapidly- changing field, the following presentation will briefly discuss the history of hemp, its legality, derivatives, and its potential future in medicine and pain treatment.
- **Legalized Cannabis in Colorado Emergency Departments: A Cautionary Review of the Negative Health and Safety Effects - Brad Roberts, MD**: Colorado legalized recreational marijuana in 2012 with legal sales beginning January 2014. This has led to novel presentations of pathology to Emergency Departments across the state. Most concerning are psychosis, suicide, and links to other substance abuse. Research shows deleterious effects on the brain including complex decision making processes, which may not be reversible with abstinence.
- Breakin' Good? …or Breakin' Bad? The Cannabis Conundrum - Steven Wright, MD: A discussion on the current state of cannabis as medicine locally, statewide, and nationally – from the MD perspective.

# Conference Presentation Tracks

**The ICR Conference 2020** was virtual. This was the fourth annual edition of this event. The ICR at Colorado State University Pueblo was pleased to host researchers and attendees from every field of cannabis expertise. The conference was an ideal forum for researchers from universities, representatives from government agencies, and a host of industry experts to share the most recent advancements in the rapidly expanding arena of cannabis research. Presentations, panels, and posters covered the scientific, medical, industrial, legal, economic, and social elements of cannabis research.

**Conference Presentation Tracks:**

1. Biology, Chemistry, Physiology, and Agronomy of Cannabis
2. Cannabinoid Pharmacology
3. Cannabis Industry
4. Economic and Social Impact
5. Hemp Cultivation, Processes, and Uses
6. Mass Media
7. Medical and Clinical Research
8. Non-medical (Industrial) Hemp
9. Public Health and Education
10. Public Policy and Regulation
11. Quality Assurance and Quality Control of Cannabis Products
12. Research administration and collaboration

# 1. Biology, Chemistry, Physiology, and Agronomy of Cannabis

## 1.1 Cannabis Physiology and Environmental Interaction

**Oral: Divalent Metals at the Plant-fungal Interface: Investigations of Iron and Copper on Growth of Penicillium Spinulosum on Hemp Seed Meal**
Ms. Tezla Neighbours - CSU-Pueblo
Prof. Sandra Bonetti - Colorado State University-Pueblo
Dr. Jim Carsella - CSU-Pueblo

**Oral: What is A Glandular Trichome in Cannabis, And What is A Major Function of Secretory Cavity?**
Dr. EunSoo Kim - CSU-Pueblo

## 1.2 Cannabis Natural Products Chemistry: Analytics & Preparative Methods

**Oral: Overcoming the Challenges Associated with Pesticide Analysis of Cannabis & Hemp Samples and Understanding the Matrix Effects**
Dr. Erasmus Cudjoe - PerkinElmer
Dr. Toby Astill - PerkinElmer
Dr. Avinash Dalmia - PerkinElmer

**Oral: An Insight into the Cuticle of the Cannabis Plant and Why a Better Chemical Understanding is Needed**
Mr. Adam Wilson - Colorado State University - Fort Collins
Dr. Joseph DiVerdi - Colorado State University - Fort Collins

## 1.3 Genomics and Genetics of Cannabis

**Oral: Insecticidal Property of Cannabidiol: CBD Disrupts Exoskeleton Development of Tobacco Hornworm (Manduca sexta)**
Mr. Sam Koch - Colorado State University-Pueblo
Dr. Sanghyuck Park - Institute of Cannabis Research
Mr. Matthieu Conroy - Colorado State University-Pueblo

**Oral: Draft Genomes of Two Hemp Accessions, Carmagnola C24 and USO31**
Dr. Sanghyuck Park - Institute of Cannabis Research
Dr. Jianwei Zhang - College of Life Science and Technology | College of Informatics, Huazhong Agricultural University

**Oral: Structural Variation in Terpene and Cannabinoid Synthase Gene Clusters Across Five Cannabis Genomes.**
Dr. Keith Allen - Front Range Biosciences

**Oral: Using High Throughput Genotyping in Hemp Breeding Applications**
Mr. Christopher Pauli - Front Range Biosciences
Mr. Anthony Torres - Front Range Biosciences
Ms. Kimberlee Neubauer - Front Range Biosciences
Dr. Reginald Gaudino - Front Range Bioscience

**Poster: Nanopore NGS Panel for Examination of Key Genes on Cannabinoid and Terpenoid Synthetic Pathways**
Ms. Jerian Reynolds - Segra International
Ms. May Cui - Segra International
Mrs. Manmeet Kaur - Segra International
Dr. Kelly Sveinson - Langara College
Dr. John Brunstein - Segra International

**Poster: Targeting Upstream Pathways to Predict Compound Profiles in Cannabis and Hemp**
Ms. Kimberlee Neubauer - Front Range Biosciences
Mr. Christopher Pauli - Front
Mr. Anthony Torres - Front Range Biosciences
Dr. Reginald Gaudino - Front Range Biosciences

## 1.4 Hemp Breeding for New Chemovars Development

**Poster: A Spatial Investigation of Metabolites in Type III Cannabis Roots**
Mr. Caleb King - Front Range Biosciences
Ms. Caroline Brugge - Front Range Biosciences
Mr. Christopher Pauli - Front Range Biosciences
Ms. Kimberlee Neubauer - Front Range Biosciences
Dr. Reginald Gaudino - Front Range Biosciences
Dr. Kymron DeCesare - Front Range Biosciences

## 1.5 Phytochemicals: Cannabinoids and Terpenes

**Oral: Thermal and Light Degradation of Cannabinoids and Terpenes From Cannabis Sativa Samples From an Industrial Hemp Farm in Lafayette, Colorado**
Mr. Kupaaikekaiao Thomas - University of Colorado Boulde
Dr. Randall Shearer - University of Colorado Boulder
Dr. Robert Sievers - University of Colorado Boulder

## 1.6 Scientifically Driven Solutions to Maximize Plant Yield and Quality

**Oral: Colorado's 2019 Hemp Growing Season – Nature's Lessons**
Dr. Robert Sievers - University of Colorado Boulder and Sievers Infinity
Dr. Randall Shearer - University of Colorado Boulder and Sievers Infinity
Mr. Kupaaikekaiao Thomas - University of Colorado Boulder
Ms. Emma Cohen - University of Colorado Boulder
Dr. Imma Ferrer - University of Colorado Boulder
Dr. Michael Thurman - University of Colorado Boulder

**Oral: Archaeal Antioxidant Used to Increase Plant Growth**
Dr. Nate Bickford - Colorado State University-Pueblo
Ms. Amanda Fullard - Colorado State University-Pueblo
Mr. Trevor Regas - Inst
Dr. Rebecca Roston - University of Nebraska Lincoln
Dr. Nicole Baun - University of Nebraska Lincoln

**Oral: Portable HPLC for 'Point of Need' Analysis of Cannabinoids in Hemp Flowers**
Mr. Sheldon Henderson - Axcend
Dr. Paul Peaden – Axcend

## 1.7 Other

**Oral: Cannabis for Pain Management and Opioid Use Reduction**
Dr. Jordan Tishler - Independent

**Oral: Hemp Regulation by States and Indian Tribes Under the New Regime of Cooperative Federalism**
Mr. David Bush - Hoban Law Group

**Oral: Experimentation on Removal of Heavy Metals From Water by Using Single and Combined Filtration Systems With Hemp Based Fibers and Zeolites**
Dr. Leonardo Bedoya-Valencia - Colorado State University-Pueblo
Mrs. Adriana Riveros-Gonzales - Colorado State University-Pueblo
Dr. Yaneth Correa-Martinez - CSU-Pueblo
Dr. Richard Farrer - Colorado State University-Pueblo

**Oral: The Rise of Marijuana: The Effects of Recreational Marijuana Sale on Crime in Colorado**
Dr. YongJei Lee - University of Colorado Colorado Springs
Dr. SooHyun O - Tarleton State University
Dr. Jessica Elgin - University of Colorado Colorado Springs

**Oral: Marijuana Tax Law: There is a Bright Line: A Gray One**
Prof. Janel Greiman - University of Northern Colorado

**Oral: Comparative Morphological, Physiological, and Biochemical Analysis of Hemp (Cannabis Sativa L) Seedlings Revealed Stress Responses Under Aeroponics System With Different Led Light Sources**
Dr. Youngseok Lim - Kangwon National University
Mr. Md. Jahirul Islam - Kangwon National University
Dr. Obyedul Kalam Azad - Kangwon National University
Mr. Ji-Woong Kim - Kangwon National University

**Oral: Unlocking a Dusty Time Capsule: Shaking out Hemp Genetics, Geography, Sector Composition, and Equity**
Dr. Jeffrey Steiner - Global Hemp Innovation Center, Oregon State University

**Oral: Measuring Cannabis Impairment in the Context of Legalization—A Paradigm Shift Is Needed**
Mr. Michael Milburn - DRUIDapp Inc.

**Poster: A Literature Analysis on Medicinal Use and Research of Cannabis in the Meiji Era of Japan**
Dr. Byungsoo Ahn - Korean Pharmacopuncture Institute
Mr. Seokhyun Kang - Korean Pharmacopuncture Institute
Mr. Kyunghoon Lee - AJ Research Institute for Korean Medicine

Ms. Seoyoon Kim - Korean Pharmacopuncture Institute
Dr. Jin Sung Park - Ajou University
Dr. Hyung-Sik Seo - Korean Medicine Hospital

**Poster: Impacts of Pollen Exclusion as a Management Practice for High-CBD Hemp Production.**

Ms. Janina Bowen - Colorado State University in Fort Collins
Mr. Brian Mitchell - Colorado State University in Fort Collins
Dr. Jacqueline Chaparro - Colorado State University in Fort Collins
Dr. Mark Uchanski - Colorado State University in Fort Collins
Dr. Jessica Prenni - Colorado State University in Fort Collins

**Poster: Evaluation of the Supplemental Led Light Impact on the Growth and Chemical Characteristics of Cannabis Sativa and C. Ruderalis Genotypes Grown in Glasshouse**

Dr. Youngseok Lim - Kangwon National University
Dr. Obyedul Kalam Azad - Kangwon National University
Mr. Soyel Rana - Kangwon National University
Dr. Kooyeon Lee - Kangwon National University
Dr. Jung Dae Lim - Kangwon National University

## 2. Cannabinoid Pharmacology

**Oral: A Simple Online Extraction LC/LC Atmospheric Pressure Ionization (APCI) MS/MS Assay for the Analysis of 17 Cannabinoids and Metabolites in Human Plasma**
Dr. Cristina Sempio - University of Colorado School of Medicine
Dr. Jelena Klawitter - University of Colorado School of Medicine
Ms. Nohemi Almaraz-Quinones - University of Colorado School of Medicine
Mrs. Wanzhu Zhao - University of Colorado School of Medicine
Dr. George Sam Wang - University of Colorado School of Medicine
Dr. Kelly Knupp - University of Colorado School of Medicine
Dr. Uwe Christians - University of Colorado School of Medicine
Dr. Jost Klawitter - University of Colorado School of Medicine

**Oral: Characterization of Commercial CBD Isolates from Colorado Hemp**
Dr. Randall Shearer - University of Colorado Boulder and Sievers Infinity
Dr. Robert Sievers - University of Colorado Boulder and Sievers Infinity
Mr. Kupaaikekaiao Thomas - University of Colorado Boulde
Ms. Emma Cohen - University of Colorado Boulder
Dr. Imma Ferrer - University of Colorado Boulder

**Oral: Dosing and Data to Enable the Prescription Pad in Cannabis Medicine**
Dr. David Gordon

**Oral: Scaling Up Pharmaceutical Production for a Gmp Cannabis Facility**
Ms. Stefanie Maletich - MedPharm Holdings

**Poster: A Systematic Review on Medicinal Use of Cannabis Referenced in Ancient Asian Literature**
Dr. Byungsoo Ahn - Korean Pharmacopuncture Institute
Mr. Kyunghoon Lee - AJ Research Institute for Korean Medicine
Ms. Seoyoon Kim - Korean Pharmacopuncture Institute
Mr. Seokhyun Kang - Korean Pharmacopuncture Institute
Dr. Jin Sung Park - Ajou University
Dr. Su-Dong Kim - Korean Pharmacopuncture Institute
Dr. Joohee Kim - Ajou University
Dr. Hyung-Sik Seo - Korean Medicine Hospital

## 3. Cannabis Industry

**Oral: CPAs and the Cannabis Industry in Colorado and Washington: Results of Quantitative and Qualitative Research on CPA Perspectives**
Prof. Suzanne Owens-Ott - Colorado Mesa University
Dr. Rick Ott - Colorado Mesa University

**Oral: Colorado Overhauls Marijuana Business Ownership Structure**
Dr. Craig Small - Hoban Law Group

**Green isn't Green: The Environmental Burden of Cannabis Cultivation**
Ms. Hailey Summers - Colorado State University
Dr. JASON QUINN - Colorado State University
Mr. Evan Sproul - Colorado State University

**Panel: 2017 to the Present, What's New with the "Legal" Status of Cannabis?**
Mr. David Bush - Hoban Law Group
Dr. Linda Schutjer - Colorado State University

**Poster: Exploring Factors to Mitigate Customers' Perceived Risk of Cannabis-related Products**
Dr. Laee Choi - Colorado State University - Pueblo

## 4. Economic and Social Impact

**Oral: Cannabis: A Remediation Treatment**
Dr. Liz McNeill - Independent Researcher

**Oral: Comparing the Economic Feasibility of using Plastic Biodegradable Mulches in Vegetable and Cannabis Production**
Dr. Margarita Velandia - University of Tennessee

**Panel: Results of Exploring the Information Practices of Cannabis Nurses**
Ms. Connie Pascal - Rutgers University - School of Communication & Information

**Poster: Behavioral Economic Demand for Cannabis: An Preliminary Extension to High Potency Concentrates**
Mr. Alex Napolitan - University of Colorado Boulder
Dr. Leah Hitchcock - University of Colorado Boulder
Dr. Meenu Minhas - Peter Boris Centre for Addictions Research | St. Joseph's Healthcare Hamilton | McMaster University
Dr. James MacKillop - Peter Boris Centre for Addictions Research | St. Joseph's Healthcare Hamilton | McMaster University
Dr. Cinnamon Bidwell - University of Colorado Boulder

## 5. Hemp Cultivation, Processes, and Uses

**Oral: Cover Crops, Pros and Cons**
Mr. Don Hijar - Pawnee Buttes Seed Inc.

**Oral: Pharmacological Actions and Potential Novel Therapeutic Uses of Some Plant and Synthetic Cannabinoids**
Prof. Roger Pertwee - The University of Aberdeen

**Oral: Profit Sharing as Means of Improving Product Quality and Mitigating Labor Cost Risks in Hemp Cultivation**
Prof. Alan Smith - Unversity of Maryland Global Campus

## 6. Mass Media

**Oral: Medical Cannabis and the Media: A Symbiotic Relationship**
Ms. Alice O'Leary Randall - Mary's Medicinals Publications

# 7. Medical and Clinical Research

## 7.1 Adverse Effects

**Oral: Subjective Adverse Effects by Method of Cannabis Administration**
Ms. Raeghan Mueller - University of Colorado Boulder
Dr. Leah Hitchcock - University of Colorado Boulder
Mr. Parker Gross - University of Colorado Boulder
Dr. Kent Hutchison - University of Colorado Boulder

**Oral: Acute Effects of Concentrated Cannabis on Motor Control and Speed: Smartphone-Based Mobile Assessment**
Dr. Leah Hitchcock - Institute of Cognitive Science, University of Colorado Boulder, CO.
Dr. Brian Tracy - Department of Health & Exercise Science, Colorado State University, Fort Collins, CO.
Dr. Cinnamon Bidwell - Department of Psychology and Neuroscience, Institute of Cognitive Science, University of Colorado Boulder, CO.

**Poster: Dr. Cinnamon Bidwell - University of Colorado BoulderPoster: Motives Matter: Marijuana Use Motives Moderate the Links between Stress and Negative Affect**
Mr. Nicholas Glodosky - Washington State University
Ms. Amanda Stueber - Washington State University
Ms. Emily LaFrance - Washington State University
Mr. Dakota Mauzay - Washington State University
Dr. Carrie Cuttler - Washington State University

**Poster: Over-Baked: Adverse Reactions to Cannabis**
Ms. Amanda Stueber - Washington State University
Ms. Emily LaFrance - Washington State University
Mr. Nicholas Glodosky - Washing
Mr. Dakota Mauzay - Washington State University
Dr. Carrie Cuttler - Washington State University

## 7.2 Cannabis Interventions for Neurological Symptoms: The Way Forward

**Oral: The Effects of Medicinal Cannabis Use on Adults With Medically Refractory Epilepsy: a Progress Report**
Dr. Barbara Brett - CSU-Pueblo

**Oral: Safety and Efficacy of Medical Cannabis to Treat Autism Spectrum Disorder Compared to Commonly Used Medications**
Dr. Richard Holdman - CDPHE
Ms. Elyse Contreras - CDPHE

**Oral: Cannabis: Adverse Allergic, Immunologic, & Respiratory Correlates**
Dr. William Silvers - University of Colorado School of Medicine
Dr. Ajay Nayak - Thomas Jefferson University

**Poster: How does CBD Modulate Learning and Memory in Humans?**
Mr. Alfredo Vargas - Colorado State University-Pueblo

Ms. Jordan Lafebre - Colorado State University-Pueblo
Ms. Lavinia Bispo - Colorado State University-Pueblo
Ms. Hanna Gebregzi - Colorado State University-Pueblo
Dr. Libby Stuyt - Crossroads Turning Point
Prof. Jeffrey P. Smith - Colorado State University-Pueblo
Prof. Moussa Diawara - Colorado State University-Pueblo

## 7.3 Genetics of the Human-Cannabis Relationship

**Poster: Impact of Marijuana Use on the Gut Microbiome in Relation to Overall Anxiety Levels**
Mr. Jerry Ma - University of Colorado Boulder
Mr. Nicholas Gonyea - University of Colorado Boulder
Dr. Jarrod Ellingson - University of Colorado Boulder
Ms. Renee Martin-Willett - University of Colorado Boulder
Prof. Cinnamon Bidwell - University of Colorado Boulder

## 7.4 Immune Function, Neurodegenerative and Cardiovascular Disorders

**Oral: The Effects of Cannabidiol on Abnormal Proliferation and Inflammation in Human Rheumatoid Arthritis Fibroblast-like Synoviocytes and Triple Negative Breast Cancer Cells**
Ms. Yoongyeong Lee - Konkuk University
Dr. Sanghyuck Park - Institute of Cannabis Research
Dr. Kyungho Lee - Konkuk University

## 7.5 Pain, Stress, Sleep and Psychiatric Disorders

**Oral: Short- and Long-term Effects of Cannabis on Post-Traumatic Stress Disorder**
Ms. Emily LaFrance - Washington State University
Dr. Carrie Cuttler - Washington State University

**Oral: Short- and Long-Term Effects of Cannabis on Headache and Migraine**
Dr. Carrie Cuttler - Washington State University
Dr. Alexander Spradlin - Washington State University
Dr. Michael Cleveland - Washington State University
Dr. Rebecca Craft - Washington State University

**Oral: Chronic Cannabis-Induced Alterations in Stress Reactivity**
Mr. Nicholas Glodosky - Washington State University
Dr. Carrie Cuttler - Washington State University
Dr. Timothy Freels - Washington State University
Dr. Ryan McLaughlin - Washington State University
**Oral: Initiating Clinical Trials with Cannabis Products**
Dr. Emily Lindley - University of Colorado
Dr. Jacquelyn Bainbridge - University of Colorado School of Medicine
Dr. Heike Newman - University of Colorado Boulder

**Oral: Cannabis, Colorado, and the Opioid Epidemic**
Dr. Kenneth Finn - Springs Rehabilitation, PC

**Panel: Cannabis Use and Psychological Pain**
Dr. Karen Yescavage - Colorado State University-Pueblo
Dr. Connie McLaughlin-Miley - Independent consultant
Ms. Wendy Alfonso - Colorado State University - Pueblo
Ms. Morgan Easter - Colorado State University - Pueblo
Ms. Lara Gribble - Colorado State University - Pueblo
Mr. Nathan Hurt - Colorado State University - Pueblo
Mr. Michael Kennedy - Colorado State University - Pueblo
Ms. Frances Martin - Colorado State University - Pueblo
Mr. Jeremy Peterson - Colorado State University - Pueblo
Ms. Catherine Sebring - Colorado State University - Pueblo

**Poster: Novel task measures acute induction of and recovery from rumination in anxious population**
Mr. Mohammad Habib - Department of Psychology and Neuroscience, University of Colorado Boulder
Dr. Leah Hitchcock - University of Colorado Boulder
Dr. Cinnamon Bidwell - Institute of Cognitive Science and Department of Psychology and Neuroscience, Univeristy of Colorado Boulder

**Poster: A Cross-Sectional and Prospective Comparison of Medicinal Cannabis Users and Controls on Self-Reported Health**
Mr. Joel Munson - Realm of Caring Foundation
Mr. Nicolas Schlienz - University at Buffalo
Mr. Ryan Vandrey - Johns Hopkins University School of Medicine

**Poster: Comparison of Cannabidiol and Citalopram in targeting Fear Memory in Female Mice**
Prof. Jeffrey P. Smith - Colorado State University-Pueblo
Ms. Amy Uhernik - CSU-Pueblo
Mr. Jose Vigil - CSU-Pueblo

**Poster: Hu-211 Sensitive, Cognitive Learning and Memory Processes Modulate Glun2b Surface Expression in the Mouse Brain**
Prof. Jeffrey P. Smith - Colorado State University-Pueblo
Ms. Amy Uhernik - Colorado State University-Pueblo
Mr. Jose Vigil - Colorado State University-Pueblo

## 7.6 Physiological Conditions (Cancer, MS, Huntington, Alzheimer, Parkinson, Ulcerative Colitis, And Aging)

**Oral: Cannabis and the Treatment of Cancer: A Rational, Data-Driven Approach**
Dr. Jordan Tishler - Independent

**Oral: A Randomized, Double-blind, Placebo Controlled, Parallel Study of Tolerability and Efficacy of Cannabidiol on Motor Symptoms in Parkinson Disease: Interim Report on Tolerability**
Dr. Maureen Leehey - University of Colorado School of Medicine
Dr. Ying Liu - University of Colorado School of Medicine
Dr. Stefan Sillau - University of Colorado School of Medicine

Dr. Sarah Fischer - University of Colorado School of Medicine
Dr. Jost Klawitter - University of Colorado School of Medicine
Dr. Cristina Sempio - University of Colorado School of Medicine
Dr. Michelle Fullard - University of Colorado School of Medicine
Dr. Trevor Hawkins - University of Colorado School of Medicine
Dr. Lauren Seeberger - University of Colorado School of Medicine
Mr. Emil Diguilio - University of Colorado School of Medicine
Mr. David VU - University of Colorado School of Medicine
Ms. Sarah Baker - University of Colorado School of Medicine
Mr. Tristan Seawalt - University of Colorado School of Medicine
Dr. Grace Chin - University of Colorado School of Medicine
Dr. Jacquelyn Bainbridge - University of Colorado School of Medicine

**Poster: Effects of Dietary Hempseed on Developmental Changes in Body Composition and Arterial Blood Pressure in Female C57BL6 Mice**

**Authors**

Ms. Hailey Streff - Colorado State University-Pueblo
Mr. Derrick Williams - Colorado State University-Pueblo
Prof. Cynthia Blanton - Idaho State Univerity, Pocatello
Prof. Annette Gabaldon - Colorado State University-Pueblo

## 7.7 Other

**Oral: Cannabis Attitudes and Knowledge Are Associated With Cannabis Use in a Population-based Survey of Active Adult Athletes**

Dr. Joanna Zeiger - Canna Research Group
Dr. William Silvers - Canna Research Group, Boulder, CO; Univserity of Colorado School of Medicine, Aurora, CO
Dr. Edward Fleegler - To Life In Peace, LLC; Canna Research Group
Dr. Robert Zeiger - Kaiser Permanente Southern California; Canna Research Group

**Oral: An Observational Study Evaluating Pharmacogenomic Variation to Identify Factors With Potential Impact on Efficacy and Safety of Medical Marijuana: Preliminary Results**

Dr. Michelle Shuffett - Independent consultant
Ms. Ragan Hart - Independent consultant
Ms. Alexandra DeKinder - Columbia Care Inc.
Dr. Rosemary Mazanet - Columbia Care Inc.

**Poster: The Potential of Whole Hemp Seed as a Prebiotic to Support Growth and Metabolism of Anticarcinogenic Probiotic Bacteria In Vitro**

Mrs. Whitney Lujan - Colorado State University-Pueblo
Prof. Annette Gabaldon - Colorado State University-Pueblo
Ms. Krystal Hrbac - Colorado State University-Pueblo

## 8. Non-medical (Industrial) Hemp

**Oral: Rheological Characteristics of Hemp Fiber/PLA Composites for Fused Filament Fabrication**
Prof. Nebojsa Jaksic - Colorado State University-Pueblo
Prof. Mel Druelinger - Colorado State University-Pueblo
Mr. Akhter Zia - Colorado State University-Pueblo

**Oral: Methods of Extraction of Biopolymers from Hemp Biomass and Production of Electrospun Nanofibers from Extracted Materials**
**Authors**
Mr. Jacob Mutz - Colorado State University - Pueblo
Mr. Benjamin Highfill - Colorado State University - Pueblo
Mr. Guy Mendel - Colorado State University - Pueblo
Dr. Richard Farrer - Colorado State University - Pueblo

**Poster: Extraction of Cellulose from Hemp Biomass for the Production of Electrospun Nanofibers**
Mr. Guy Mendel - Colorado State University - Pueblo
Mr. Benjamin Highfill - Colorado State University - Pueblo
Mr. Jacob Mutz - Colorado State University - Pueblo
Dr. Richard Farrer - Colorado State University - Pueblo

**Poster: The Creation of Electrospun Nanofibers Derived from Lignin and Cellulose Extracted from Hemp Biomass Using Deep Eutectic Solvents**
**Authors**
Mr. Jacob Mutz - Colorado State University - Pueblo
Mr. Guy Mendel - Colorado State University - Pueblo
Mr. Benjamin Highfill - Colorado State University - Pueblo
Dr. Richard Farrer - Colorado State University - Pueblo

## 9. Public Health and Education

**Oral: Werehab: a Mobile Application to Help Cannabis Rehabilitation**
Dr. Yoanna Long - Colorado State University-Pueblo
Dr. Kuang-Yuan Huang - Colorado State University-Pueblo
Ms. Xiao Cui - Colorado State University-Pueblo
Mr. Michael Zamora - Colorado State University-Pueblo
Mr. David Lichliter - Colorado State University-Pueblo

**Oral: How to Make the Most Optimal Rules for Governing the Hemp Industry and Avoid Bureaucratic Dictatorship**
Dr. Cindy Phillips - Hemp Analytics

**Oral: Investigating Alcohol and Cannabis Co-use in a Survey Sample of Regular Cannabis Users and a Clinical Sample of Heavy Drinkers Enrolled in Alcohol Treatment**
Dr. Hollis Karoly - University of Colorado Boulder
Ms. Chrysta Andrade - University of Colorado Boulder
Ms. Alexandra Zabelski - University of Colorado Boulder
Dr. Cinnamon Bidwell - University of Colorado Boulder
Dr. Kent Hutchison - University of Colorado Boulder

**Panel: The Road Ahead: CDOT & Partners Present Latest Marijuana-Impaired Driving Data, Trends, Research and Education Efforts**
Dr. Denise A Valenti - IMMAD, LLC
Ms. Allison Rosenthal - CDOT
Mr. Glenn Davis - Highway Safety Manager, Colorado Highway Safety Office
Ms. Shannon Fender - Native Roots Dispensary
Mr. Sam Aspnes - Colorado Department of Transportation

**Spanish Language Cannabis and Health Survey: Improving Diversity and Representation in Community-Based Cannabis Research**
Ms. Renee Martin-Willett - University of Colorado Boulder
Ms. Elizabeth Zambrano Garza - University of British Columbia
Dr. Cinnamon Bidwell - University of Colorado Boulder

## 10.Public Policy and Regulation

**Oral: Ex Post Evaluation: A New Paradigm in Drug Control Policy**
Dr. Stephen Ziegler - Center for Effective Regulatory Policy & Safe Access

**Panel: Colorado Hemp Advancement and Management Plan (CHAMP) & Identifying and Overcoming Potential Challenges Along the Hemp Supply Chain.**
**Authors**
Ms. Rebecca Laurie - Colorado Department of Regulatory Agencies
Dr. Max Nathanson - CDA
Dr. Kenneth Boldt - CDA
Dr. Daniel Glenn - CDA
Dr. Brian Koontz - CDA
Mr. Jeff Lawrence - CDPHE, Director
Dr. Peg Brown – CDA

**Oral: Finding a Path Forward: The Legal and Regulatory Status of CBD**
**Authors**
Mrs. Stacey Worthy - Aimed Alliance

## 11.Quality Assurance and Quality Control of Cannabis Products

**Systematic Variety Naming in Cannabis: Necessity and Approaches**
Dr. John Brunstein - Segra International
Ms. May Cui - Segra International
Ms. Jerian Reynolds - Segra International

## 12.Research administration and collaboration

**Marijuana Research at the National Institute on Drug Abuse**
Dr. Heather Kimmel - National Institute on Drug Abuse, NIH

**Chuncheon Bioindustry Foundation and Cannabis**
Dr. Meehwa Shin - Chuncheon Bioindustry Foundation

**Seed-to-insight™ Cannabis Solution Provides Overlooked Chain of Custody Piece in Hemp Cultivation**
Mrs. Terri Miller - SignaKey, LLC

## 1.1 Biology, Chemistry, Physiology, and Agronomy of Cannabis
Cannabis Physiology and Environmental Interaction

# Divalent Metals at the Plant-fungal Interface: Investigations of Iron and Copper on Growth of Penicillium Spinulosum on Hemp Seed Meal


### Authors
Ms. Tezla Neighbours - CSU-Pueblo
Prof. Sandra Bonetti - Colorado State University-Pueblo
Dr. Jim Carsella - CSU-Pueblo



### Abstract
Fungi are responsible for the majority of pre- and post-harvest plant diseases and destroy a third of all food crops annually. In humid climes and indoor greenhouses, plants such as hemp are especially susceptible to mycosal infections. In addition to the detrimental effects of fungi on plant growth, crops and plant products destined for human consumption are frequently contaminated with pathogenic fungi such as *Aspergillus* and/or toxic fungal metabolites. This is especially dangerous for immunocompromised individuals such as cancer patients undergoing chemotherapy who may be using *Cannabis* products to mitigate the treatment side effects. For these reasons, our investigations focus on the factors that promote fungal growth on hemp products. Our investigations examine the ability of *Penicillium spinulosum* to grow on milled hemp seed with and without glucose supplementation of a standard growth medium. Our studies have shown that the fungus flourishes in media supplemented with hemp seed even without the addition of glucose and that addition of hemp seed promotes the production of extracellular glycohydrolases. Past studies showed that copper induces production of these enzymes. Because the enhancement of glycohydrolases by hemp seed meal requires further investigation, our studies examine the iron and copper content in milled hemp seed, and in fungal cultures grown in Standard Growth media with and without hemp seed meal by ICP-MS. These metals were selected due to their centrality to many biological processes and location in enzyme active sites. These investigations will establish whether copper and iron in hemp seed lead to the induction of fungal glycohydrolases that may contribute to infection and destruction of *Cannabis* by fungi.


### Topic Areas
Cannabis Physiology And Environmental Interaction, Cannabis Natural Products Chemistry: Analytics & Preparative Methods

### Submission Format
Oral

# What is A Glandular Trichome in Cannabis, And What is A Major Function of Secretory Cavity?

**Authors**
Dr. EunSoo Kim - CSU-Pueblo

**Abstract**
Glandular trichomes are thought to be functionally specialized tissues that produce various secondary metabolites, which are then stored or volatilized at the plants surface. Glandular trichomes in the genus of Cannabis cover all aboveground surface parts of the plant. Characteristically, they are most abundant on the floral bracts of pistillate plants. Three types of glandular trichomes such as bulbous, capitate-sessile, and capitate-stalked trichomes are recognized in Cannabis. Capitate-stalked trichomes are an excellent model to carry out studies on secretion because of their large size, abundance on bracts, ease of isolation, and ease of micro-pipetting for secretory cavity contents. This study was performed with capitate-stalked trichomes using a transmission electron microscope to determine how the glandular trichomes form the noncellular secretory cavity, and how the secretions pass through the cell wall and accumulate in vesicles of the secretory cavity. The gland head consist of disc cells containing cytoplasm and a non-cellular intrawall secretory cavity. The lipoplasts in the disc cells of globose heads synthesize lipophilic terpenes that migrate through the plasma membrane and into the cell wall adjacent to the secretory cavity. These substances subsequently pass through the cell wall and accumulate in the secretory cavity in the form of secretory vesicles. Numerous vesicles of different sizes and densities are localized in the secretory cavity. In summary, lipophilic terpenes and phenols, when released from their respective lipoplasts and vacuole compartments, accumulate in the plasma membrane/cell wall interface, where enzymes combine these precursors into cannabinoids. Mature glands possess the highest concentration of major cannabinoids in the secretory cavity, such as CBD in the fiber strains and THC in the drug strains of Cannabis sativa.

**Topic Areas**
Cannabis Physiology And Environmental Interaction, Phytochemicals: Cannabinoids and Terpenes, Others
**Submission Format**
Oral

## 1.2 Biology, Chemistry, Physiology, and Agronomy of Cannabis
Cannabis Natural Products Chemistry: Analytics & Preparative Methods

### Overcoming the Challenges Associated with Pesticide Analysis of Cannabis & Hemp Samples and Understanding the Matrix Effects

**Authors**
Dr. Erasmus Cudjoe - PerkinElmer
Dr. Toby Astill - PerkinElmer
Dr. Avinash Dalmia - PerkinElmer

**Abstract**
A new analytical LC-MS/MS method has been developed and qualified to allow cannabis laboratories to complete the entire Pesticide assay (including molecules such as Chlordane and pentachloronitrobenzene) in one quick method, using one instrument. Data will be presented to show the long-term stability of the method, simplicity of sample preparation and techniques to overcome matrix effects, robustness towards any contamination from the dirty matrices, and detection limits well below the State requirements (LOQ<=10 ppb). References will show that having a validated method and SOP for the cannabis testing industry is key in ensuring the highest quality of cannabis reaches the patient. In addition, the influences of the various cannabis sample types tested will be discussed, and details specified on how to handle flower, concentrates, and edibles.

**Topic Areas**
Cannabis Natural Products Chemistry: Analytics & Preparative Methods
**Submission Format**
Oral

# An Insight into the Cuticle of the Cannabis Plant and Why a Better Chemical Understanding is Needed

**Authors**
Mr. Adam Wilson - Colorado State University - Fort Collins
Dr. Joseph DiVerdi - Colorado State University - Fort Collins

**Abstract**
The advent of the cannabis analytics within Colorado has allowed for the use of cannabis products in new therapeutic and recreational avenues. Due to this a range of testing instrumentation and standards have been mandated of the products created. While the focus of testing is on therapeutic compounds of interest and potential toxicants introduced during production and procession of cannabis products, there is a lack of interest in understanding the holistic chemistry of the plant itself. The cuticle of the plant is one such area that demands further understanding of its chemical constitution and interaction with current compounds of interest, cannabinoids and terpenes, as the cuticular components have similar chemical properties. Agricultural cannabis samples were analyzed by common industry techniques and instrumentation, GC-FID and GC-MS, in an attempt to characterize components of the complex cuticular matrix of the plant and multiple compounds were identified.

**Topic Areas**
Cannabis Natural Products Chemistry: Analytics & Preparative Methods, Others
**Submission Format**
Oral

## 1.3 Biology, Chemistry, Physiology, and Agronomy of Cannabis
Genomics and Genetics Of Cannabis

### Insecticidal Property of Cannabidiol: CBD Disrupts Exoskeleton Development of Tobacco Hornworm (Manduca sexta)

**Authors**
Mr. Sam Koch - Colorado State University-Pueblo
Dr. Sanghyuck Park - Institute of Cannabis Research
Mr. Matthieu Conroy - Colorado State University-Pueblo

**Abstract**
Cannabidiol (CBD) has received much attention in recent years due to the recognition of its medicinal potential. Despite the long history of cultivation by humans, the intrinsic evolutionary question on why cannabis produces phytocannabinoids has not been fully addressed. Our preliminary data suggests CBD plays a defensive role against herbivorous insects by inhibiting growth and development. Additionally, long-term CBD administration significantly reduced total crude protein in the CBD-treated hornworm group by 34% compared to control groups, while non-polar lipids, glucose, and water retention remained unchanged. To have a better understanding on how CBD impacted insect growth, an RNA-Seq approach was used to catalog differentially expressed genes. The analysis identified a total of 26,000 genes. Among them, 36 genes (>1,000-fold) appeared to be highly up- and down-regulated. Interestingly, genes that were involved in exoskeleton formation such as cuticle-like and collagenase were highly regulated in response to CBD administration. To further investigate if CBD had any effects on insect's metabolic profiles, gas chromatography time-of-flight mass spectrometry analysis (GC-TOF-MS) was performed on lyophilized insect samples. In the CBD-fed insects, three amino acids: asparagine, L-aspartic acid, and β-alanine, were significantly increased by 2.8-, 2.1-, 17-fold respectively, while trehalose was decreased by 5.6-fold. Asparagine, L-aspartic acid, and β-alanine are essential to the production of N-β-alanyldopamine (NBAD) and dopamine, which are essential precursors to sclerotization/tanning of the insect cuticle. Based on the observational, metabolic and transcriptomic profiles, CBD may impact the biochemical pathways involved in sclerotization (cuticle hardening) leading to premature or unregulated ecdysis. Further study and analysis of cuticle and chitin production during tobacco hornworm development will help us understand the defense mechanism of CBD on biochemical pathways involved in sclerotization.

**Topic Areas**
Genomics And Genetics Of Cannabis, Phytochemicals: Cannabinoids and Terpenes
**Submission Format**
Oral

## Draft Genomes of Two Hemp Accessions, Carmagnola C24 and USO31

**Authors**
Dr. Sanghyuck Park - Institute of Cannabis Research
Dr. Jianwei Zhang - College of Life Science and Technology | College of Informatics, Huazhong Agricultural University

**Abstract**
*Cannabis sativa* L., also known as hemp or marijuana, is an annual dioecious plant that produces at least 120 cannabinoids in the glandular trichomes of female flowers. The two main constituents are cannabidiol (CBD) and tetrahydrocannabinol (THC). The plant has been used by mankind for over 4,000 years for its recreational and medicinal uses. Recent clinical tests demonstrated therapeutic potentials of CBD in various human diseases including Dravet syndrome. Despite the potency as a drug, genetic mechanisms underlying agriculturally important traits including cannabinoid/terpenoid biosynthesis pathway have not been fully understood. In this study, draft genomes of two hemp varieties, Carmagnola C24 (female) and USO31 (male), were sequenced with PacBio SMRT technology, *de novo* assembled with FALCON unzip, then polished with Pilon. The assembled genomes (primary contigs) for C24 and USO31 are about 885 Mb and 984 Mb in size with 469 Mb and 533 Mb haplotigs, respectively, which indicates very high heterozygosity of the hemp genomes. Assisted with HiC data, two sets of phased pseudomolecules for each line were obtained. BUSCO evaluations showed at least 89.2%-91.9% completeness of the two genomes. Further MAKER annotation analyses predicted 28,228 (phase 0) and 27,946 (phase 1) protein-coding genes in C24 genome, and 29,059 (phase 0) and 29,063 (phase 1) in USO31 by using RNA-Seq data as evidences. All data generated will serve as a valuable genetic resource for investigating the mechanisms of cannabinoid biosynthesis in hemp.

**Topic Areas**
Genomics And Genetics Of Cannabis
**Submission Format**
Oral

## Structural Variation in Terpene and Cannabinoid Synthase Gene Clusters Across Five Cannabis Genomes.

**Authors**
Dr. Keith Allen - Front Range Biosciences

**Abstract**
About half of the 55 terpene synthase genes in Cannabis, and a similar proportion of the twenty or so cannabinoid synthase genes, are in fairly compact clusters, typically (but not always) containing very similar genes, suggesting relatively recent duplication events. I will describe substantial variation in the structure of two gene clusters, a set of monoterpene synthases, and a set of cannabinoid synthases that includes the CBCA Synthase, across five substantially complete Cannabis genomes. The level of variation includes presence absence variation, total gene number with a cluster, inter gene spacing, intron length, and possible loss of entire gene clusters. The level of variation I will describe has implications for how we think about Cannabis breeding as this level of variation suggests that varietal breeding down to the level of actual gene content will be reasonable with available germ plasm.

**Topic Areas**
Genomics And Genetics Of Cannabis
**Submission Format**
Oral

## Using High Throughput Genotyping in Hemp Breeding Applications

**Authors**
Mr. Christopher Pauli - Front Range Biosciences
Mr. Anthony Torres - Front Range Biosciences
Ms. Kimberlee Neubauer - Front Range Biosciences
Dr. Reginald Gaudino - Front Range Biosciences

**Abstract**
Genotyping methods for Cannabis have advanced greatly in the last few years, with marker assisted breeding and genotyping by sequencing being most commonly used. This talk focuses on a method of variant identification analysis, referred to as high resolution melting (HRM), which is currently being applied to guide the breeding of our hemp population through identifying the genotypic diversity in various crosses and parental lines. We will explain how the process of HRM analysis works and some background on the development work that went into creating these breeding tools. With the genotypes of various genes involved in cannabinoid and terpenoid biosynthesis identified via HRM, we are applying this knowledge to rapidly breed new varieties and unique combinations of traits through genetic selection. The markers presented will focus on the total accumulation of cannabinoids and the ratios of those cannabinoids, as well as some discussion towards our developing markers to build on our nascent understanding of terpene biosynthesis. In addition to the data presented on the individual markers, we will show how understanding the combination of genotypes from multiple markers can be applied as a group to work as a fingerprint of Cannabis, that can also be applied in other various breeding applications.

**Topic Areas**
Genomics And Genetics Of Cannabis, Hemp Breeding For New Chemovars Development , Phytochemicals: Cannabinoids and Terpenes
**Submission Format**
Oral

# Nanopore NGS Panel for Examination of Key Genes on Cannabinoid and Terpenoid Synthetic Pathways

**Authors**
Ms. Jerian Reynolds - Segra International
Ms. May Cui - Segra International
Mrs. Manmeet Kaur - Segra International
Dr. Kelly Sveinson - Langara College
Dr. John Brunstein - Segra International

**Abstract**
Cannabis varieties are commonly bred or selected for expressed cannabinoid and / or terpenoid profiles. Allelic variation of key genes in the cannabinoid and / or terpenoid pathways would be expected to have phenotypic impact. Thus, an understanding of significant variation in these genes would potentially be useful in underpinning marker assisted selection strategies for breeding novel varieties. To investigate, we have applied the Oxford Nanopore MinION sequencer and the PCR Barcoding Expansion to a multi-sample, multiple gene target panel. Our pilot method, currently covering 10 genes from the cannabinoid synthetic pathway and 3 terpene synthase genes, has been applied to nearly 50 samples. Target genes from each sample are independently amplified, followed by pooling, barcoding, library preparation, and NGS. Bioinformatic demultiplexing allows for separated target gene sequences from each sample to be individually analyzed at well supported depths of coverage. Comparison of these genomic sequences against extant cDNA sequences allows for determination of predicted amino acid sequences for each target. Unlike common short read NGS technologies, where allelic phasing can be unclear, the use of Nanopore long read sequencing may allow for easier resolution of individual parentally derived allelic sequences.
Derived amino acid sequence(s) for each examined gene target were aligned and amino acid substitutions were examined in comparison to paired chemotypic data where available (the majority of samples tested). Specific dramatic differences in chemotypic profile were observed to clearly associate with particular amino acid substitutions in some target genes. Where possible, we have mapped these substitutions back onto available protein crystallographic structures to attempt to assess whether these observed changes are merely linked or are more likely directly mechanistically relevant to chemotype. Overall, we find this method represents a relatively low cost, high yield approach to uncovering markers of utility in directed cannabis breeding programs.

**Topic Areas**
Genomics And Genetics Of Cannabis
**Submission Format**
Poster

## Targeting Upstream Pathways to Predict Compound Profiles in Cannabis and Hemp

**Authors**
Ms. Kimberlee Neubauer - Front Range Biosciences
Mr. Christopher Pauli - Front
Mr. Anthony Torres - Front Range Biosciences
Dr. Reginald Gaudino - Front Range Biosciences

**Abstract**
Genotyping has increasingly become a more reliable tool for breeding cannabis and hemp. Using carefully designed primers, certain regions of the genome can be targeted and using high resolution melting technology, differences in those regions can be determined down to a single nucleotide change by the amplicon melting profile. Some regions targeted can determine the cannabinoid ratios, show different groups plants may fall into, or predict other compound profiles. Recently, upstream pathways have become a target of interest in genotyping cannabis and hemp. By targeting regions that code for precursor enzymes that feed the supply of substrate for cannabinoid and terpene synthases, early detection of chemotype potential and other profiles can be determined.

**Topic Areas**
Genomics And Genetics Of Cannabis, Hemp Breeding For New Chemovars Development
**Submission Format**
Poster

## 1.4 Biology, Chemistry, Physiology, and Agronomy of Cannabis
Hemp Breeding for New Chemovars Development

### A Spatial Investigation of Metabolites in Type III Cannabis Roots

**Authors**
Mr. Caleb King - Front Range Biosciences
Ms. Caroline Brugge - Front Range Biosciences
Mr. Christopher Pauli - Front Range Biosciences
Ms. Kimberlee Neubauer - Front Range Biosciences
Dr. Reginald Gaudino - Front Range Biosciences
Dr. Kymron DeCesare - Front Range Biosciences

**Abstract**
*Cannabis spp.* roots remain one of the least examined plant characteristics despite significant below-ground biomass. The roots are a rich source of metabolites, including flavonoids, alkaloids, terpenoids, and cannabinoids serving to protect below-ground vascular tissue and influence the rhizosphere. To our knowledge, only one previous study has observed significant concentrations of cannabinoids in *Cannabis* roots, but without corresponding above-ground biomass observations. This study sought to detect and quantify cannabinoids in the roots of Type III (high-CBD, low-THC) *Cannabis* strains using reverse-phase high performance liquid chromatography. This study's unique high-resolution analysis of different root taxonomy assessed the spatial distribution of cannabinoids in below-ground tissue. Root cannabinoid production was also compared to above-ground cannabinoid flower and leaf tissue concentrations with the potential to correlate above and below-ground biomass; thus, providing a second indicator of varietal total biomass value prior to inflorescence.

**Topic Areas**
Hemp Breeding For New Chemovars Development , Phytochemicals: Cannabinoids and Terpenes, Cannabis Natural Products Chemistry: Analytics & Preparative Methods
**Submission Format**
Poster

## 1.5 Biology, Chemistry, Physiology, and Agronomy of Cannabis
Phytochemicals: Cannabinoids and Terpenes

# Thermal and Light Degradation of Cannabinoids and Terpenes From Cannabis Sativa Samples From an Industrial Hemp Farm in Lafayette, Colorado

**Authors**
Mr. Kupaaikekaiao Thomas - University of Colorado Boulde
Dr. Randall Shearer - University of Colorado Boulder
Dr. Robert Sievers - University of Colorado Boulder

**Abstract**
Some hemp-drying methods alter the chemical profile of the samples, because many chemicals degrade when they are exposed to heat or light.
*Cannabis sativa* samples were collected from an industrial hemp farm in Lafayette, Colorado from September 16$^{th}$ – 25$^{th}$. The samples were dried in a greenhouse and a barn without windows for eight weeks. The concentrations of the cannabinoids and terpenes in the dried samples are being analyzed with Gas Chromatography (GC) and High-Performance Liquid Chromatography (HPLC). This work is ongoing, but the results should be available by January 2020 at the latest, months before the Institute of Cannabis Research (ICR) Conference in April 2020.
The hypothesis is that cannabinoids and terpenes will degrade the least when they are dried in a barn without windows, because barn drying involves almost zero light exposure. Comparable amounts of heat are involved in both barn and greenhouse drying.
These results could help companies determine which drying methods they should use to maximize the production of certain cannabinoids or terpenes.

**Topic Areas**
Phytochemicals: Cannabinoids and Terpenes
**Submission Format**
Oral

## 1.6 Biology, Chemistry, Physiology, and Agronomy of Cannabis
Scientifically Driven Solutions to Maximize Plant Yield and Quality

# Colorado's 2019 Hemp Growing Season – Nature's Lessons

**Authors**
Dr. Robert Sievers - University of Colorado Boulder and Sievers Infinity
Dr. Randall Shearer - University of Colorado Boulder and Sievers Infinity
Mr. Kupaaikekaiao Thomas - University of Colorado Boulder
Ms. Emma Cohen - University of Colorado Boulder
Dr. Imma Ferrer - University of Colorado Boulder
Dr. Michael Thurman - University of Colorado Boulder

**Abstract**
The story of every harvest begins in the spring with sowing. This year, the Sievers group planted three high CBD producing hemp varieties comprised of approximately 500 Cherry Wine clones, 300 River Rock and 200 Otto II plants started from seed in a greenhouse. Plants were spaced about every 5 feet in black plastic sheeting rows, 5 feet apart at center, and were grown on one half acre in Lafayette, CO. We studied methods of hemp farming with particular emphasis on yield of the aforementioned varieties, weed control using a CDA-approved herbicide and methods for drying and shucking (hand vs. machine). Abundant rain led to a bountiful yield, as well as vigorous growth of weeds, especially bind weed. Considerable effort was required to detect and remove male River Rock plants. Their removal without replacement reduced plot yield, and fertilized female plants produced abundant amounts of seed. Nevertheless, total yield of extractable biomass exceeded that of the same plot in 2018 by at least 33%. Preliminary results comparing three types of drying facilities (barn, greenhouse, field) show no great differences in yield of CBD, other than field drying yields an aesthetically unattractive product that was brown or grayish in color. CBD yields were evaluated by HPLC analysis. Extraction was completed using supercritical fluid CO2 resulting in a highly pure isolate of greater than 98% purity (NMR), and minor cannabinoid impurities were identified by HPLC with TOF-MS detection. Numerous photographs from the ground and overhead by drone provide an insightful qualitative summary of our observations and conclusions.

**Topic Areas**
Scientifically Driven Solutions to Maximize Plant Yield and Quality
**Submission Format**
Oral

## Archaeal Antioxidant Used to Increase Plant Growth

**Authors**
Dr. Nate Bickford - Colorado State University-Pueblo
Ms. Amanda Fullard - Colorado State University-Pueblo
Mr. Trevor Regas - Inst
Dr. Rebecca Roston - University of Nebraska Lincoln
Dr. Nicole Baun - University of Nebraska Lincoln

**Abstract**
Oxidative stress is a byproduct of harsh environmental conditions and can limit efficient growth throughout the three kingdoms of life. Ultra-reactive side-products of an oxygen-based metabolism can damage critical cellular components and force programmed cell death. In plants, the cell's redox status is intimately tied to interpreting environmental cues. A byproduct of this stress is a chemical that acts as an antioxidant that has the potential to increase cannabis growth. A convenient complex ecosystem for testing this question is aquaponics because it is a complete and yet contained ecosystem that is scalable for agricultural purposes. We sprayed archaeal antioxidant weekly to increase cannabis yield in an aquaponics system.
We have 10 identical aquaponics systems, 5 sprayed with water and 5 sprayed with archaeal antioxidant containing genetically identical cannabis clones propagated from a single mother plant to limit genetic variability within samples. Light quality, quantity, and duration were kept uniform across samples. Morphological measurements such as height, stem dry weight, leaf dry weight, and flower dry weight were recorded. Chemical components, such as cannabinoids and terpenes, were analyzed for each sample. This project allowed us to measure the benefits of redox supplementation to provide a cheaper resource for agricultural supplementation.

**Topic Areas**
Scientifically Driven Solutions to Maximize Plant Yield and Quality
**Submission Format**
Oral

## 1.7 Biology, Chemistry, Physiology, and Agronomy of Cannabis
Other

### Cannabis for Pain Management and Opioid Use Reduction

**Authors**
Dr. Jordan Tishler - Independent

**Abstract**
Pain, from various sources, is the number one complaint of patients in the United States. It is also the number 1 problem that patients state is poorly addressed by their clinicians. This has lead, in recent years, to the over-prescription of opioid pain medications, resultant over-use or misuse of these medications, addiction, increased use of illegal opiates like heroin, and overdose related deaths. The federal government, having only lately caught on to this trend, has called it an “epidemic” and released multiple documents describing ways to reduce opioid prescription, none of which truly address the underlying problem: patients’ pain.
Further, a secondary issue of what to do about patients who have already become dependent on opiates has been met with plans that leave much to be desired, and often do not adequately address patients’ pain. Cannabis has been shown to effectively address pain from multiple sources,1 and has a much better safety profile than opiates.3 It has also been shown that Cannabis use concomitantly with opioids can reduce the amount of opioids needed,2.4 presumably increasing patient safety. In many instances, Cannabis can treat pain sufficiently that all opiates can be discontinued.5 There is some preliminary data on using Cannabis to detox patients from opiates.6,7
In this session, I will present a synopsis of the evidence mentioned above and address clinical approaches to real-world treatment of patients with chronic pain who are either using, or not yet using, opioids medications.

**Topic Areas**
Others
**Submission Format**
Oral

## Hemp Regulation by States and Indian Tribes Under the New Regime of Cooperative Federalism

**Authors**
Mr. David Bush - Hoban Law Group

**Abstract**
For over 20 years, states have charted their own regulatory pathways to legalize marijuana and hemp within their respective jurisdictions and give birth to the expanding markets in Cannabis that we witness today. But significant changes are coming in the hemp space, as demonstrated by passage of the landmark Farm Bill in December 2018 and promulgation by the United States Department on October 31, 2019 of new federal rules establishing a national hemp regulatory program. A (somewhat) coordinated system for hemp regulation on a national scale is beginning to emerge.
The new national hemp regime is a form of "cooperative federalism" which, in many respects, will resemble the patchwork of regulations that characterize much of the administration of health care and environmental laws in the United States, including Medicare and the Clean Water Act. States are invited to administer the federal hemp regulatory program, while given broad discretion to implement their own rules and pursue their own objectives.
David Bush will sketch the outlines of the emerging new system of federal-state hemp law in which the many states, territories and Indian tribes across America will regulate hemp in similar, but also different ways. How this patchwork of semi-coordinated regulation of hemp by multiple levels of government will affect national markets and interstate (and ultimately, international) commerce in hemp is an open question that only time may answer.

**Topic Areas**
Others
**Submission Format**
Oral

# Experimentation on Removal of Heavy Metals From Water by Using Single and Combined Filtration Systems With Hemp Based Fibers and Zeolites

**Authors**
Dr. Leonardo Bedoya-Valencia - Colorado State University-Pueblo
Mrs. Adriana Riveros-Gonzales - Colorado State University-Pueblo
Dr. Yaneth Correa-Martinez - CSU-Pueblo
Dr. Richard Farrer - Colorado State University-Pueblo

**Abstract**
Currently, heavy metal pollution is a major problems in the environment. The impact of toxic metal ions can be minimized by using different technologies, among them filtration. Cellulose based materials and zeolites have been used in heavy metal sequestration, due to their low economic cost and widespread availability, and also the potential to treat wastewater at a large scale. Both type of materials are available in abundant quantity, are cheap and have low or little economic value. Natural based cellulose based materials, including materials derived from the Hemp plant and zeolites will be used to produce filtration systems used in different metal detoxification in contaminated water. In this research single filters using both hemp based cellulose and zeolites and combined filters (using both zeolites and hemp based cellulose) will be tested in order to measure their efficiency at treating metal-contaminated water.

**Topic Areas**
Others
**Submission Format**
Oral

# The Rise of Marijuana: The Effects of Recreational Marijuana Sale on Crime in Colorado

**Authors**
Dr. YongJei Lee - University of Colorado Colorado Springs
Dr. SooHyun O - Tarleton State University
Dr. Jessica Elgin - University of Colorado Colorado Springs

**Abstract**
With the legalization of marijuana use in Colorado, the retail sale of marijuana began on January 1, 2014, and the number of marijuana dispensaries for medical and recreational use increased dramatically. However, there is a limited empirical study examining the relationship between the increased number of marijuana dispensaries and crime in Colorado. This paper employs a difference-in-differences technique to estimate the impact of marijuana dispensary openings on both violent crimes and property crimes in Colorado Springs, Colorado. We also test the impact of marijuana dispensary opening on other drug-related crimes under the assumption that marijuana dispensary openings are in a reversible relationship to drug-related crime. Finally, we discuss the policy implications related to marijuana dispensary business in Colorado as well.

**Topic Areas**
Others
**Submission Format**
Oral

## Marijuana Tax Law: There is a Bright Line: A Gray One

**Authors**
Prof. Janel Greiman - University of Northern Colorado

**Abstract**
The states' tax laws are in perpetual independent motion. The United States remains principally unmoved. However, there is much commotion about which could transform this disparity.

Keeping pace with the changing marijuana laws is a continuously moving target for accountants, attorneys and businesses. All marijuana remains illegal at the Federal level. Most states have chosen to buck the Federal laws and create their own distinctive laws; all the while knowing that the federal government could chose to crack down at any time. Everyone involved with the marijuana industry, from patient to accountants, could be indicted. Federal tax returns are defiantly filed by the thousands. Financial institutions, banks in particular, are the most cautious players as a result of strict Federal banking regulations. Nearly all marijuana business transactions are conducted by tendering cash.

The marijuana industry has insidiously moved from being a novelty fascination to be a mainstream item. All states with legal recreational marijuana first legalized medical marijuana. Many states have entered the second phase by legalizing recreational marijuana. A few states are entering a third phase by focusing on specific items. Some of the more popular items are lounges where marijuana can be publicly consumed and pushing to expunge criminal records for actions that were but are no longer illegal.
For example, the Las Vegas City Council approved the licensing of marijuana lounges. The Nevada legislature quickly overrode this measure by requiring the Cannabis Compliance Board to address issues that have risen as a result of allegedly rushed cannabis policies. However, there is an operational tasting lounge in Nevada. It resides on sovereign tribal land located essentially in Las Vegas. It even also has a 24-hour drive through! It will be interesting to watch for push-back from casinos.
Creative pioneers are finding ways to circumvent obdurate states statutes.

**Topic Areas**
Others
**Submission Format**
Oral

# Comparative Morphological, Physiological, and Biochemical Analysis of Hemp (Cannabis Sativa L) Seedlings Revealed Stress Responses Under Aeroponics System With Different Led Light Sources

**Authors**
Dr. Youngseok Lim - Kangwon National University
Mr. Md. Jahirul Islam - Kangwon National University
Dr. Obyedul Kalam Azad - Kangwon National University
Mr. Ji-Woong Kim - Kangwon National University

**Abstract**
Plant growth, development and their adaptability through adjusting enzymatic and non-enzymatic antioxidants were studied on hemp under 10 LED light spectrum in a controlled aeroponic system, where natural light was used as a control (Natural light, White, R:B:G:W:FR:UV, R:B:G, R:B, R:B:G:FR, R:B:W:FR, R:B:W:FR:UV, R:B:FR:UV, R:B:G:FR:UV, and R:B:FR). Light treatments were imposed on 25 days aged seedlings for 16 hours (300 µmol $m^{-2}s^{-1}$) where a similar nutrient solution was used, and data were collected 20 days after treatment applied. From the results, higher effect was observed in node number among all growth parameters in different LED spectra. Chlorophyll a & b were significantly increased, and chlorophyll a/b ratio were decreased while carotenoid concentration was found almost same as control under all light spectra. Higher photosynthetic rate, and water use efficiency were observed in white, R:B:G and R:B while higher transpiration and stomatal conductance were recorded from white, R:B:G, R:B, R:B:G:FR:UV and R:B:FR with similar quantum yield compare to control. Lower malondialdehyde was found in white, R:B:G, R:B, and R:B:W:FR while lower $H_2O_2$ was produced from R:B:G:W:FR:UV and R:B:G:FR:UV spectra. Both TSC and sucrose were increased in R:B:W:FR, R:B:W:FR:UV, R:B:FR:UV and R:B:G:FR:UV while no significant increment of proline and ascorbic acid were observed in either spectral combination compare to control. Interestingly, higher activities were observed for all enzymes (SOD, CAT, APX & GPX) in all spectral combination. In conclusion, the spectral combination R:B:G:W:FR:UV, R:B, R:B:G:FR, R:B:W:FR and R:B:FR:UV found as stress for plant as they produce high amount of ROS consequently higher activity of SOD and CAT with lower osmolytes. On the other hand, the plants were found well adapted with higher growth and development in white, R:B:G, R:B:W:FR:UV, R:B:G:FR:UV and R:B:FR spectral combination.

**Topic Areas**
Others
**Submission Format**
Oral

## Unlocking a Dusty Time Capsule: Shaking out Hemp Genetics, Geography, Sector Composition, and Equity

**Authors**
Dr. Jeffrey Steiner - Global Hemp Innovation Center, Oregon State University

**Abstract**
Hemp, a new-old crop, has missed out on 80 years of discovery and innovation that have propelled agricultural productivity to this point in time when more food, feed, and fiber are produced for so many, by so few, than ever before. The efficiencies by which agricultural-based products are produced are staggering compared to early in the last century, but with these increases have come additional economic, environmental, and social challenges to the long-term sustainability of farms, communities, and the planet. The potential for hemp is widely touted as a solution to improve health outcomes, provide new renewable products, and expand economic development, but what does that really mean? This presentation reviews the status of hemp as an emergent commodity finding its way into existing agricultural landscapes and markets, and provides perspectives on its possibilities for the future and what is needed to get there.

**Topic Areas**
Others
**Submission Format**
Oral

## Measuring Cannabis Impairment in the Context of Legalization—A Paradigm Shift Is Needed

**Authors**
Mr. Michael Milburn - DRUIDapp Inc.

**Abstract**
Blood, urine, and saliva tests and measured changes in the eyes are widely used as proxy measures of alcohol or drug impairment. In the case of cannabis, however, these tests are not, in fact, reliably associated with actual impairment. Because cannabis impairment lasts for an hour or so after consumption, while evidence of cannabis remains in the body for more than three weeks thereafter, measuring its bodily presence very rarely correlates with impairment. Moreover, frequent cannabis consumers often develop a tolerance to the drug's psychoactive effects. Accordingly, courts across the country are beginning to require *proof of actual impairment* to uphold employers' decision to fire or refuse to hire medical cannabis patients or other legal users of cannabis. Impairment Science, Inc. has developed DRUID®, an app for mobile devices that *assesses impairment directly* in just under 3 minutes, using a collated set of objective measures taken as users complete 4 tasks: reaction time, decision-making accuracy, time estimation, and balance. Research with frequent and infrequent cannabis consumers has demonstrated the DRUID® app's accuracy and reliability as an impairment measurement tool, thus giving cannabis consumers the ability to determine their level of impairment before driving, working in a safety-sensitive job, or engaging in other high risk activities.

**Topic Areas**
Others
**Submission Format**
Oral

# A Literature Analysis on Medicinal Use and Research of Cannabis in the Meiji Era of Japan

**Authors**
Dr. Byungsoo Ahn - Korean Pharmacopuncture Institute
Mr. Seokhyun Kang - Korean Pharmacopuncture Institute
Mr. Kyunghoon Lee - AJ Research Institute for Korean Medicine
Ms. Seoyoon Kim - Korean Pharmacopuncture Institute
Dr. Jin Sung Park - Ajou University
Dr. Hyung-Sik Seo - Korean Medicine Hospital

**Abstract**
Cannabis is a historical plant which has been used as a medicine in East Asia. These days, there are active debates about using cannabis in clinical field. Collecting and comparing cannabis research articles which had been published in the Opening of Japan to spot the interactions between the traditional medicine of Japan, Rangaku which was established in Edo Period and the European medicine which is transferred after Perry Expedition is academically meaningful.

This study searched publications, which were listed on Open-Access databases by Dec. 11, 2019. We collected research articles which had been published from January 3, 1867 to July 30, 1912 also known as Meiji era and uploaded on Open-Access databases. Our searching databases were J-stage, CiNii(Scholarly and Academic Information Navigator), Tokyo Metropolitan Library, The National Diet Library, IRDB(Institutional Repositories DataBase) and KAKEN(Grant-in-Aid for Scientific Research Database). Searching keywords were cannabis, hemp and all of their Japanese synonyms and their available combinations. We selected final 15 studies which met every selection criteria in the 346,393 collected studies.

Cannabis was prescribed in Meiji era of Japan to alleviate pain and cure the digestive, respiratory, urinary, and nervous system diseases such as indigestion, asthma, tuberculosis, gonorrhea and its complications, insomnia, and nervous prostration. Its efficacy was reported on several journals, also it was administered to almost same symptoms similarly to Korean medicine.

Cannabis was medically used in Meiji era of Japan and the reporting and sharing of its clinical effect was published on the medical journals like present days. There were already Cannabis regulations in that era, but its medicinal use was more liberated than nowadays. It may be a chance to reconsider the current legal system, which strictly controls the use of Cannabis.

Key Words
cannabis, clinical medicine, historical review, hemp, Meiji era

**Topic Areas**
Others
**Submission Format**
Poster

# Impacts of Pollen Exclusion as a Management Practice for High-CBD Hemp Production.

**Authors**
Ms. Janina Bowen - Colorado State University in Fort Collins
Mr. Brian Mitchell - Colorado State University in Fort Collins
Dr. Jacqueline Chaparro - Colorado State University in Fort Collins
Dr. Mark Uchanski - Colorado State University in Fort Collins
Dr. Jessica Prenni - Colorado State University in Fort Collins

**Abstract**
Production of high-CBD hemp (*Cannabis sativa* L.) is steadily increasing in Colorado and across the United States. However, the impact of management practices for this crop remain relatively unexplored. For example, there is high potential for fiber and grain cultivars of male hemp plants to pollinate female hemp plants grown in close proximity, but it is unknown how the cannabinoid content of high-CBD hemp flowers is affected by pollination. We hypothesized that high seed content following pollination will negatively impact the phytocannabinoid profile of the flower. In this study, 4 experimental pollen exclusion treatments were applied to two cultivars of high-CBD hemp, Cherry Uno and Wife. Treatments included non-woven thick row cover (largest pore size approximately 50 micrometer), non-woven thin row cover (largest pore size approximately 200 micrometer), woven insect netting (average pore size 700x240 micrometer), and uncovered controls. Clones were transplanted on June 13, 2019 at the Agricultural Research, Development and Education Center South (ARDEC South) at Colorado State University in Fort Collins, Colorado (lat. 40.611804 N; long. -104.997144 W; elevation 1525 meters). 5 cm inflorescence samples (2 inches per Colorado Department of Agriculture sampling protocol) were taken from each plant. Early results suggest that all 3 pollen exclusion materials reduced pollination while not impacting total biomass. Trends in the data suggest thin and thick row cover reduced pollination more than insect netting. Flower tissue will be extracted and analyzed using ultra-high performance liquid chromatography coupled with tandem mass spectrometry (UHPLC-MS/MS) to determine the quantitative profiles of 18 phytocannabinoids.

**Topic Areas**
Others
**Submission Format**
Poster

# Evaluation of the Supplemental Led Light Impact on the Growth and Chemical Characteristics of Cannabis Sativa and C. Ruderalis Genotypes Grown in Glasshouse

**Authors**
Dr. Youngseok Lim - Kangwon National University
Dr. Obyedul Kalam Azad - Kangwon National University
Mr. Soyel Rana - Kangwon National University
Dr. Kooyeon Lee - Kangwon National University
Dr. Jung Dae Lim - Kangwon National University

**Abstract**
Light is one of the most important growth factors in cannabis cultivation. Light quality, intensity, and photoperiod play an immense role in the successful growth and development. The main objective of this study was to examine the full spectrum supplemental artificial LED light (401-500 nm 26%, 501-600 nm 29%, 601-700 nm 40%, far-red 5%) effect on the growth characteristics of the two different cannabis varieties namely *Cannabis sativa* L. and *Cannabis ruderalis* L. The cannabis was grown for 70 days (sativa) and 120 days (ruderalis) under supplemental light having constant photosynthetic photon flux density (PPFD) of >500 $\mu molm^{-2}s^{-1}$. The photoperiod was 16/8 hr. and 10/14 hr. (D/N) during vegetative growth (40 days for sativa and 60 days for ruderalis) and flowering stage, respectively. The control was done without supplemental light where light intensity was 200 – 700 $\mu molm^{-2}s^{-1}$ during the study. It is observed that the effect of supplemental light is variety dependent. The Cannabis sativa did not affect by the additional light regarding plant height, branch number, fresh weight and dry weight compared to grown under without supplemental light. At the same time, the growth characteristics and inflorescences of ruderalis was increased when grown under supplemental LED light compared to without supplemental light. Therefore, it is concluded that the requirement of supplemental light is cannabis variety dependent where *C. sativa* is non-sensitive whereas *C. ruderalis* is sensitive to photoperiod in terms of their growth behavior. Other characteristics such as chemical compositions of several genotypes of *Cannabis sativa L.* and *Cannabis ruderalis* will also be presented.

**Topic Areas**
Others
**Submission Format**
Poster

## 2. Cannabinoid Pharmacology

### A Simple Online Extraction LC/LC Atmospheric Pressure Ionization (APCI) MS/MS Assay for the Analysis of 17 Cannabinoids and Metabolites in Human Plasma

**Authors**
Dr. Cristina Sempio - University of Colorado School of Medicine
Dr. Jelena Klawitter - University of Colorado School of Medicine
Ms. Nohemi Almaraz-Quinones - University of Colorado School of Medicine
Mrs. Wanzhu Zhao - University of Colorado School of Medicine
Dr. George Sam Wang - University of Colorado School of Medicine
Dr. Kelly Knupp - University of Colorado School of Medicine
Dr. Uwe Christians - University of Colorado School of Medicine
Dr. Jost Klawitter - University of Colorado School of Medicine

**Abstract**
**Aim:** In recent years, the surge of clinical trials involving tetrahydrocannabinol (THC) and cannabidiol (CBD) increased the need for sensitive and specific analytical assays to establish dose-effect relationships and gain knowledge into the pharmacokinetics and metabolism of cannabinoids. We developed and validated an online extraction high-performance liquid chromatography tandem mass spectrometry (LC/LC-MS/MS) method for simultaneous quantification of 17 cannabinoids and metabolites including THC and its metabolites, CBD and its metabolites and other minor cannabinoids in human plasma.
**Methods:** CBD-glucuronide (CBD-gluc) standard is not commercially available. It was produced in-house by isolation of CBD-gluc from urine of patients enrolled in an IRB-approved clinical study using pure CBD oil. For calibration standards and quality control samples, human plasma was spiked with cannabinoids at varying concentrations within the working range of the respective compound and 200 µL was extracted using a simple one-step protein precipitation procedure. The extracts were analyzed using online trapping LC/LC-atmospheric pressure chemical ionization (APCI)-MS/MS running in the positive multiple reaction monitoring (MRM) mode.
**Results:** The method was validated according to FDA guidelines; matrix effect and recovery were evaluated according to Matuszewski et al. Acceptance criteria for intra- and inter-batch accuracy (85-115%) and precision (<15%) were met for all compounds in plasma. To date, 219 plasma samples collected during clinical and observational studies were analyzed and 175 were positive for CBD, 201 for 7-CBD-COOH, 168 for CBD-gluc, 122 for 7-OH-CBD, 76 for 6α-OH-CBD and only 2 for 6β-OH-CBD.
**Conclusion:** We present a validated, high-throughput, sensitive and specific assay that includes the most commonly screening cannabinoids and, for the first time, all major CBD metabolites. This assay could be useful to monitor THC, CBD and their metabolites during clinical monitoring and research studies, especially when a better understanding of the administered dose and time of administration is needed.

**Topic Areas**
Dosing and Data to Enable the Prescription Pad in Cannabis
**Submission Format**
Oral

# Characterization of Commercial CBD Isolates from Colorado Hemp

**Authors**
Dr. Randall Shearer - University of Colorado Boulder and Sievers Infinity
Dr. Robert Sievers - University of Colorado Boulder and Sievers Infinity
Mr. Kupaaikekaiao Thomas - University of Colorado Boulde
Ms. Emma Cohen - University of Colorado Boulder
Dr. Imma Ferrer - University of Colorado Boulder

**Abstract**
CBD is a non-psychoactive cannabinoid that is legally derived from hemp. Preclinical and clinical studies suggest it possesses beneficial properties for treatment of a wide variety of ailments. Studies have used various CBD sources, purities and dosages. Consistency of CBD purity is an area that needs to be addressed, as there are a lack of well-characterized standards and protocols.
We chose to evaluate the purity of several commercially produced CBD isolates from Boulder County and one sample from Colorado Springs. Most of these were produced from primary supercritical fluid carbon dioxide extraction but at least one was from using iso-propyl alcohol and one was from using ethyl alcohol. NMR was used for purity assays as it is not dependent on having an authentic standard, as well as for its ease of use. Exact mass HPLC-TOF-MS was used for identification of impurities. In NMR analysis, a highly pure, stable, non-cannabinoid and certified reference material is used for quantification by the internal standard method. This technique eliminates dilution and injection errors, as well as reducing negative impacts from sample and standard degradation.
All CBD isolates were found to contain similar impurities and all met the requirement of the 2018 Farm Bill, less than 0.3% THC by dry weight. Isolates produced from supercritical fluid carbon dioxide were generally purer. One sample produced from ethanol extraction contained more odor and acquired a slight brownish tinge over time. Our propriety extraction technique was found to remove odor and color of this sample, as well as  THC to lower levels. This study demonstrates that highly-pure commercially-available CBD isolates are being produced and development of even purer isolates is possible.

**Topic Areas**
Dosing and Data to Enable the Prescription Pad in Cannabis
**Submission Format**
Oral

## Dosing and Data to Enable the Prescription Pad in Cannabis Medicine

**Authors**
Dr. David Gordon - NA

**Abstract**
As cannabis medicine is considered by more consumers, patients and doctors, somehow, there is still no way to create predictable, reproducible outcomes. Consumers have a limited knowledge base, meaning they must rely on trial and error to find products that work. As a result, patients can't use these medicines without the fear of losing control, physicians can't confidently recommend them and manufacturers have no way to understand what's working for patients or how to refine their products. The demand for alternative medicine has never been stronger, but a lack of accurate data, identified dosing protocols and reliably predictable outcomes is holding back widespread adoption. As interest increases, it's imperative we develop platforms to ensure physicians can prescribe, and patients can use cannabis medicine safely and effectively. This track focuses on finding solutions to these challenges – and how physicians, product formulators and researchers are working to create a future of prescribable cannabis medicine.

**Topic Areas**
Dosing and Data to Enable the Prescription Pad in Cannabis
**Submission Format**
Oral

## Scaling Up Pharmaceutical Production for a Gmp Cannabis Facility

**Authors**
Ms. Stefanie Maletich - MedPharm Holdings

**Abstract**
Whether a drug batch is 10 units or 10,000 units, the production process matters. Beginning with a new cannabis formulation idea, to proof-of-concept trials, then progressing to bench scale and commercial scale production batches, there are many challenges that arise during scale-up of drug preparations. Developing cannabis products also has its own unique concerns with regards to drug consistency and compliance. In a GMP environment, considerations must also be made for product quality, personnel safety and hygiene, production traceability, and facility maintenance. This presentation will examine these factors and more during the process of scaling up production of cannabis pharmaceuticals, and illustrate an example cannabis product as a case study.

**Topic Areas**
Pioneering the Advancements of Cannabinoid Pharmaceuticals
**Submission Format**
Oral

# A Systematic Review on Medicinal Use of Cannabis Referenced in Ancient Asian Literature

**Authors**
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Mr. Kyunghoon Lee - AJ Research Institute for Korean Medicine
Ms. Seoyoon Kim - Korean Pharmacopuncture Institute
Mr. Seokhyun Kang - Korean Pharmacopuncture Institute
Dr. Jin Sung Park - Ajou University
Dr. Su-Dong Kim - Korean Pharmacopuncture Institute
Dr. Joohee Kim - Ajou University
Dr. Hyung-Sik Seo - Korean Medicine Hospital

**Abstract**
Cannabis, from the plant Cannabis sativa or Cannabis indica species, has been used as a medicinal plant for thousands of years in Asia. Recently, there has been increased attention on the diverse therapeutic potential of cannabis. In modern medicine, the most common uses for medical cannabis include painful muscle spasm, severe or long-term pain, and chemotherapy-induced nausea and vomiting. However, little previous research has been conducted to explore the traditional and historical applications of cannabis described in ancient literature. In this article, historical origins and uses of the cannabis plant described in East Asian literature were reviewed. A systematic literature search including medical and agricultural documentation in ancient literature was conducted using the databases such as Google Scholar, Scopus, National Assembly Library of Korea, National Library Korea, China National Knowledge Infrastructure (CNKI), Scholarly and Academic Information Navigator of Japan (CiNii), and Korean Traditional Knowledge Portal (KTKP). The keywords searched were cannabis, cannabis sativa, cannabis radix, cannabis semen, cannabis fructus, hemp, hemp seed, Sin-nong-bon-cho-gyeong (神農本草經), Dong-ui-bo-gam (東醫寶鑑), Bon-cho-kang-mok (本草綱目), Bon-cho-do-gyeong(本草圖經), Myeong-ui-byeol-lok (名醫別錄), Bon-cho-gyeong-jip-ju (本草經集注), O-bo-bon-cho (吳普本草), Sin-su-bon-cho (新修本草), Nong-jeong-hoe-yo (農政會要), Gyeong-yak-jeon-seo (景岳全書), Bang-yak-hap-pyeon (方藥合編). The conditions listed or of adverse events of cannabinoids were also included. The terms in English, as well as oriental languages including Chinese, Japanese, and Korean were also searched. The search and screening were completed by one investigator and then independently confirmed by a second. The literature review revealed that cannabis was used as a fiber and food crop as well as medical indications such as dystocia, constipation, anesthesia, insomnia, and blood stasis syndrome. As the use and acceptance of medicinal cannabis continue to evolve, and understanding the history of cannabis and its usage is essential for the successful integration of cannabis into modern clinical practices.
Key Words: cannabis, cannabis fructus, hemp, Korean medicine, pharmacology, review

**Topic Areas**
Others
**Submission Format**
Poster

## 3. Cannabis Industry

### CPAs and the Cannabis Industry in Colorado and Washington: Results of Quantitative and Qualitative Research on CPA Perspectives

**Authors**
Prof. Suzanne Owens-Ott - Colorado Mesa University
Dr. Rick Ott - Colorado Mesa University

**Abstract**
Two studies were recently completed related to Certified Public Accountants (CPAs) and the marijuana industry. The first was a qualitative study designed to investigate accounting and tax services that CPAs are willing, or not willing, to provide to marijuana-related businesses in Colorado and Washington, the two most mature marijuana markets. The grounded theory qualitative study investigated the following research questions.

1. Why are some CPAs unwilling to provide services to marijuana-related businesses?
2. How do MRBs compensate for lack of CPA services?
3. What does a CPA need to know about the marijuana industry prior to engaging to provide services to MRBs?

The second, follow-up, study surveyed approximately 100 CPAs in Colorado and Washington. The purpose of this research was to determine the perceptions regarding ethical issues of CPAs regarding the provision of accounting services to the marijuana industry in states that have legalized marijuana usage. The second study answered the following research questions:

1. Why are CPAs unwilling to provide services to marijuana-related businesses?
2. What do CPAs believe is the primary risk related to serving the marijuana industry?

The findings of these studies indicate that, while many CPAs will not serve the industry, there are competent and knowledgeable CPAs who will. The primary reason CPAs provided for not serving the marijuana industry was that it is still federally illegal. CPAs who do choose to serve the industry will require extensive industry knowledge to be successful. Respondents indicated that they were more concerned about the risk related to lack of technical industry

knowledge to competently service the marijuana industry than risk related to federal prosecution or the risk of losing the CPA license to practice. A very small percentage of respondents indicated they had ethical or moral objectives with serving the marijuana industry.

**Topic Areas**
Business Administration
**Submission Format**
Oral

## Colorado Overhauls Marijuana Business Ownership Structure

**Authors**
Dr. Craig Small - Hoban Law Group

**Abstract**
Colorado Overhauls Marijuana Business Ownership Structures and Qualifications Opening Up The Marijuana Market to Compete With Other Marijuana Legalization States
When Colorado's Green Rush began in 2009 marijuana regulatory authorities implemented an overly strict marijuana regulatory scheme that extremely controlled who could own a Colorado marijuana business and what roles non-owners would have in those same businesses. Ten years, thirty-three medical marijuana states, eleven legal recreational marijuana states and the District of Columbia later Colorado has had to completely overhaul its marijuana business ownership structures and qualifications in order to compete with other free market states to attract marijuana capital and investment dollars.
This presentation will focus on House Bill 19-1090, "Concerning Measures to Allow Greater Investment Flexibility in Marijuana Businesses" and its real-world implementation in both rules and policies. Specifically, Craig Small will discuss the introduction of publicly traded corporations into Colorado's regulated marijuana business ownership structure, controlling beneficial owners vs. passive beneficial owners and disclosures required of directors, officers, managers and those in "Control" of a Colorado regulated marijuana business. He will provide an overview of Colorado Department of Revenue: Marijuana Enforcement Divisions forms, which forms are to be used under what scenarios and address form specific issues. Finally, he will also discuss where Colorado has relaxed regulated marijuana business ownership qualifications as well other interest changes of note.
This presentation will provide some guidance on local jurisdiction implementation of the above issues where such guidance is available.

**Topic Areas**
Legal Requirements
**Submission Format**
Oral

# Green isn't Green: The Environmental Burden of Cannabis Cultivation

**Authors**
Ms. Hailey Summers - Colorado State University
Dr. JASON QUINN - Colorado State University
Mr. Evan Sproul - Colorado State University

**Abstract**
Cannabis cultivation has exponentially grown since legalization, yet little is known about the industry's greenhouse gas emissions (GHGs). With 48% of American adults having tried cannabis at some point in their lives and 22% of adults regularly consuming, understanding the GHGs of cannabis cultivation is essential for consumers, the general public and policy makers to improve decision-making with respect to reducing effects of climate change. The vast majority, 80%, of legally grown cannabis is cultivated inside warehouse-like buildings because a consistent product can be delivered year-round, despite geographic and seasonal variations in weather. This work models the energy required to maintain a comfortable indoor grow environment, along with all materials needed, and translates outputs to GHGs using life cycle assessment methodology. The analysis was performed across the United States, accounting for geographic variations such as electric grid emissions and weather. Results show GHGs are substantial across the U.S. ranging from roughly 2200 to 5200 kg CO2e per kg-dried flower, largely due to indoor environmental controls, lights and carbon dioxide for increased plant growth. Regional trends show that areas such as the Colorado Rockies and Midwest United States are more than twice as GHG intensive for growing cannabis indoors than regions like the East and West Coasts. Translating cumulative GHG results to a consumer level, GHGs from one cannabis cigarette are roughly equal to a serving of beef, depending on where it's grown.

**Topic Areas**
Others
**Submission Format**
Oral

## 2017 to the Present, What's New with the "Legal" Status of Cannabis?

**Authors**
Mr. David Bush - Hoban Law Group
Dr. Linda Schutjer - Colorado State University

**Abstract**
A panel of experts will discuss current issues surrounding cannabis legalization and public policy.

**Topic Areas**
Legal Requirements
**Submission Format**
Panel

## Exploring Factors to Mitigate Customers' Perceived Risk of Cannabis-related Products

**Authors**
Dr. Laee Choi - Colorado State University - Pueblo

**Abstract**
Perceived risk refers to the nature and amount of risk perceived by a consumer in contemplating a particular purchase decision. Before making purchase decision, customers expect that the purchase helps to attain some set of goals, but they perceive risks because of uncertainty regarding that the planned purchase will allow them to achieve their goals. The uncertainty may result from a variety of factors inherent in the product, brand/firm, information sources, and so on. The amount of risk perceived by the customer is a function of two factors: the amount at stake determined by the importance of the buying goals and the individual's feeling of subjective certainty. Especially, when deciding the usage of innovative and new products such as Cannabis-derived products, risks customers perceive may be higher than the usage of general products because of high amount at stake and low subjective certainty that results from lack of direct and indirect experiences with the Cannabis-derived products.

Researchers and marketers are paying attention to the Cannabis-derived products, while there is no investigation pertaining to how customers' perceived risk should be handled. Thus, this study first aims to examine what factors—based on product, brand/firm, and information sources--influence perceived risks and how marketing strategies for each factor help to reduce perceived risks. Second, when customers have high perceived risks, they are less likely to buy the product or brand. However, some factors may help to alleviate the perceived risks by leading customers to purchase the products. For example, addiction level, prior experience with the product, and/or severity of diseases may strengthen the buying goals of customers.

To answer these research questions, the data based on the survey are being collected from U.S. customers. After analyzing the date, we will be able to present if the proposed research model would be confirmed.

**Topic Areas**
Business Administration
**Submission Format**
Poster

## 4. Economic and Social Impact

### Cannabis: A Remediation Treatment

**Authors**
Dr. Liz McNeill - Independent Researcher

**Abstract**
The false propaganda and official discourse on cannabis that facilitated prohibition not only influenced capitalist production and consumption, but impacted health and wellness outcomes. Prior to prohibition, physicians regularly prescribed cannabis tinctures for a host of symptoms and illnesses. Criminalizing cannabis had a tremendous impact on the sociopolitical outcomes, in particular on female reproductive health. Prohibition created and perpetuated a false discourse of fear to demonize cannabis as the cause and exasperation of gynecological illness and symptoms. In reality, cannabis can eliminate symptoms and put many gynecological diseases into remission.
One example is endometriosis, a female health crisis effecting between 10-20% of women. For many, endometriosis causes chronic and debilitating pain and inflammation not only affecting reproductive and hormonal processes, but often other areas of the body. Recent studies indicate a 50-62% increases in heart attack risk for females with endometriosis. Despite the dire statistics, few treatment options exist and treatment outcomes are poor. However, there is promising evidence for utilizing cannabis for treatment. The biggest barriers to medicinal cannabis for endometriosis are the lack of knowledge about the disease and the fear tactics touted as sound medical advice following prohibition. Direct, applicable knowledge of how cannabis can treat endometriosis and a host of other gynecological conditions is poorly understood. However, we now have evidence cannabis alleviates symptoms of endometriosis because cannabis relieves pain and inflammation, supports the immune system, and helps to remediate the endocannabinoid system. Medicinal cannabis applications are diverse and dependent on a whole host of variables such as hormonal makeup, symptoms, location, etc. Our work now is to continue to identify integrative approaches to understand the applications of cannabis for not only endometriosis, but the potential to alleviate a whole host of female reproductive health issues.

**Topic Areas**
Economic and social impact, Others
**Submission Format**
Oral

# Comparing the Economic Feasibility of using Plastic Biodegradable Mulches in Vegetable and Cannabis Production

**Authors**
Dr. Margarita Velandia - University of Tennessee

**Abstract**
The use of polyethylene (PE) mulch in vegetables, as well as cannabis production, is considered unsustainable because of its contribution to soil plastic pollution. Plastic biodegradable mulches (BDMs) are a more sustainable option because they are tilled into the soil or composted at the end of the cropping season, and designed to decompose into water, carbon dioxide, and microbial biomass reducing soil plastic pollution. Regardless of the potential environmental benefits associated with the use of BDMs, farmers will have to evaluate the changes in costs and benefits when transitioning from PE mulch to BDM before making the decision to adopt BDMs. For example, although there are savings (i.e., reduction of labor, for removal and disposal activities, and elimination of disposal cost) associated with the use of BDM, this type of mulch is more expensive than PE mulch. This presentation will focus on the evaluation of the factors associated with the economic feasibility of adopting BDM in vegetable production using a partial budget analysis. We will also explore the potential factors associated with the economic feasibility of adopting BDM in cannabis production. Our research results suggest that the cost of BDM compared to PE mulch, and labor costs have the greatest impact on the changes in net profits when transitioning from PE mulch to BDM.

**Topic Areas**
Others
**Submission Format**
Oral

## Results of Exploring the Information Practices of Cannabis Nurses

**Authors**
Ms. Connie Pascal - Rutgers University - School of Communication & Information

**Abstract**
*Exploring the Information Practices of Cannabis Nurses* is an interdisciplinary, multi-theoretical dissertation study that incorporates information science, communication, and knowledge management perspectives to study the phenomenon of cannabis nursing through the lens of their information practices. Information practices theorize and emphasize the embodiment and sociological aspects of information seeking in everyday life. Designed using qualitative methods, this study examines a sample of 31 self-described cannabis nurses currently practicing some form of cannabis care in the United States. Semi-structured interviews were used to produce transcripts that were analyzed using thematic and theoretical coding techniques. This strategy produced a rich description of not only how, but why these nurses are both seeking and becoming trusted sources of information.
The results of this study suggest the therapeutic use of cannabis is evolving in unusual ways from other medical innovations and modalities including the nurses' rejection of physicians and the pharmaceutical industry as cognitive authorities; the emergence of a network of practice around cannabis care; and the role of cannabis nurses as specialists, boundary spanners, early adopters, and entrepreneurs.
Findings from this study point to the urgent need for the development of information systems including decision support and research tools that are driven by patient/plant genomics; patient journaling and communication systems; and 'lite' electronic medical records software that can accommodate cannabis therapeutics.
The implications of this study point to the pressing need for more and better education about cannabis and cannabis therapeutics for clinicians, patients, and the public in general. The conclusions developed from this study will prove useful to software designers, nurse educators, and researchers in healthcare, information science, communication, and knowledge management as well as those interested in cannabis informatics, information seeking, practice theory, and adult learning.

**Topic Areas**
Others
**Submission Format**
Panel

# Behavioral Economic Demand for Cannabis: An Preliminary Extension to High Potency Concentrates

**Authors**
Mr. Alex Napolitan - University of Colorado Boulder
Dr. Leah Hitchcock - University of Colorado Boulder
Dr. Meenu Minhas - Peter Boris Centre for Addictions Research | St. Joseph's Healthcare Hamilton | McMaster University
Dr. James MacKillop - Peter Boris Centre for Addictions Research | St. Joseph's Healthcare Hamilton | McMaster University
Dr. Cinnamon Bidwell - University of Colorado Boulder

**Abstract**
**Background:** Concentrated cannabis sales are increasing at unprecedented levels and are 3-5x more potent than flower, containing 60-90% tetrahydrocannibol (THC). However, concentrates are understudied in comparison and an increase in potency may alter cannabis' reinforcing efficacy. The marijuana purchase task (MPT) measures cannabis' reinforcing properties from a behavioral economic perspective, gauging hypothetical cannabis consumption at increasing prices. This project investigates whether MPT demand indices differ in users of high potency concentrates.
**Methods:** Experienced cannabis users (N=406, 56% male, mean concentrate use: 22.9 days/month, SD = 8.1) reported cannabis use frequency via the validated Timeline Follow Back (TLFB) survey and completed the MPT, assessing use and five demand indices for cannabis: $Q_0$ (consumption when free), $O_{max}$ (maximum expenditure), $P_{max}$ (price where consumption decreases), breakpoint (price where consumption ceases), and a (rate of change in demand). Preliminary analysis determined whether frequent concentrate users (FC, n=100, concentrate use >4 days/week) display greater demand for flower than frequent flower (FF, n=100, flower use >4 days/week, concentrate use 1-3 days/week), and non-concentrate (NC, n=57, concentrate use <1 day/month) users.
**Results:** $Q_0$, $O_{max}$, and a differed by cannabis user group (ps <0.001), with higher $Q_0$, $O_{max}$, and lower a in FC users compared to NC (ps < 0.001) and FF users (at trend-levels). The number of overall cannabis use days modestly correlated to all demand indices (rs: 0.11-0.42, ps < 0.031).
**Conclusion:** Frequent concentrate users indicated greater inelasticity of demand on the MPT compared to non-concentrate users and at trend level in frequent flower users (as indicated by higher $Q_0$, higher $O_{max}$, and lower a). This indicates a relatively higher demand for cannabis among concentrate users and suggests the reinforcing properties of cannabis may vary as a function of frequent concentrate use. Future analyses will determine if dependence symptoms interact with concentrate group on MPT indices.

**Topic Areas**
Economic and social impact, Others
**Submission Format**
Poster

## 5. Hemp Cultivation, Processes and Uses

### Cover Crops, Pros and Cons

**Authors**
Mr. Don Hijar - Pawnee Buttes Seed Inc.

**Abstract**
Growing cover crops to control weeds can be a challenging approach to growing hemp. We will explore the pros and cons of using cover crops. Cover Crops assist in weed suppression by denying unwanted plants the resources they depend on to grow and establish; by reallocating water, sunlight and soil use to your cover crop, these resources are left unavailable for unwanted plants to abuse.

Cover crops do use precious moisture though & irrigation water is expensive. The question is, do you use water to grow hemp or cover crops?

**Topic Areas**
Irrigation / Soil Fertilization, Pest And Weed Management, Practical Weed Management in Outdoor Hemp Cultivation
**Submission Format**
Oral

# Pharmacological Actions and Potential Novel Therapeutic Uses of Some Plant and Synthetic Cannabinoids

**Authors**
Prof. Roger Pertwee - The University of Aberdeen

**Abstract**
Cannabis is a source of at least 120 compounds collectively known as phytocannabinoids. Of these, only two have so far been approved for clinical use: Δ9-tetrahydrocannabinol (THC; Marinol®) as an anti-emetic, cannabidiol (CBD; Epidiolex®) for treating childhood epilepsy, and THC plus CBD (Sativex®) for ameliorating multiple sclerosis. I will review evidence (1) that CBD and three other non-psychoactive phytocannabinoids, cannabidiolic acid (CBDA), cannabigerol (CBG) and Δ9-tetrahydrocannabivarin (THCV), possess pharmacological properties of potentially important therapeutic relevance, and (2) that a synthetic CBDA analogue, HU-580, is more "druggable" than CBDA. More specifically, (1) CBD, CBDA and HU-580 appear to act via 5-HT1A receptors to ameliorate anxiety and chemotherapy-induced nausea and vomiting, (2) CBG can induce α2-adenoceptor-mediated pain relief and (3) THCV is a CB1 cannabinoid receptor antagonist and CB2 cannabinoid receptor agonist, and may therefore, ameliorate disorders such as diabetic renal nephropathy and nicotine dependence. There is evidence too that THCV might induce 5-HT1A receptor-mediated amelioration of schizophrenia. In addition to HU-580, just one other example of a novel synthetic phytocannabinoid is a water soluble "THC prodrug"; this also has therapeutic potential as it ameliorates signs of glaucoma, at least in rabbits. Endocannabinoids play an "autoprotective" role in various disorders, raising the possibility that enhancing their activation of cannabinoid CB1 and/or CB2 receptors might be therapeutically beneficial. I will review evidence that administering a CB1 positive allosteric modulator (PAM) that strengthens CB1 receptor activation by targeting a CB1 allosteric site, can suppress signs of inflammatory and neuropathic pain in mice without producing signs of tolerance or dependence. Additionally, I shall present quite recent evidence that there is also an allosteric site on the CB2 receptor, and that a novel positive allosteric modulator of this site displays anti-cancer properties.

**Topic Areas**
Others
**Submission Format**
Oral

# Profit Sharing as Means of Improving Product Quality and Mitigating Labor Cost Risks in Hemp Cultivation

**Authors**
Prof. Alan Smith - Unversity of Maryland Global Campus

**Abstract**
A persistent problem confronting outdoor hemp cultivators is the hiring of adequate reliable, skilled laborers sufficiently motivated to return to the worksite and behave productively, day-after-day, throughout the growing season. In the tight agricultural labor market currently besetting hemp growers, workers with such characteristics have often demanded distressingly high wages in exchange for their labor. In many cases, however, the accommodation of worker demands has forced employers to pay a wage level that poses a large financial risk – with no guarantee of commensurate financial rewards. The theoretical model presented in this session offers an alternative to the traditional system of strict hourly pay for agricultural workers, including those that attempt to manage field weeds. The theory proposes a system in which workers are paid a normal hourly wage, but in addition, annual enterprise profits are shared with workers. The model's 's-curve' distribution schedule gradually increases the amount of profits shared with workers as enterprise profits increase, and as accompanying enterprise risks simultaneously decrease. This provides a novel system of incentives in which agricultural laborers should rationally choose to improve their individual and collective performances, and in turn the amount of money they earn from employment, as a reward for hard work, deliberation, precision, innovation, and collaboration. In turn, this should ultimately endow workers with a much higher quality of life, while simultaneously minimizing both their own financial risk *and* the capital investment risks of their employers. While the model is theoretically applicable to most agricultural operations, the outdoor cultivation of hemp, a decidedly risky and labor-intensive endeavor – especially in regard to the elimination of weeds – presents an excellent opportunity to empirically test the practicability of the model, due to the significantly higher levels of potential profitability of hemp cultivation over most other field crops.

**Topic Areas**
Practical Weed Management in Outdoor Hemp Cultivation
**Submission Format**
Oral

# 6. Mass Media

## Medical Cannabis and the Media: A Symbiotic Relationship

**Authors**
Ms. Alice O'Leary Randall - Mary's Medicinals Publications

**Abstract**
The medical cannabis industry owes its very existence to seriously ill patients who advocated, often in the media, for the right to legally use cannabis. This movement began in 1976 when a college professor, Robert C. Randall, who was afflicted with glaucoma, proved to the courts and then to federal agencies that cannabis, when added to conventional medications, lowered his intraocular pressure to the safe range thus staving off blindness. Randall, whose Masters degree was in rhetoric, proved a powerful spokesperson for a new movement—the medical marijuana movement. This oral presentation will highlight the noteworthy patients who laid the groundwork for today's medical cannabis industry, including Randall; cancer patient Lynn Pierson who, in 1978, persuaded the New Mexico legislature to pass the first-of-its-kind medical marijuana legislation; Barbra and Kenny Jenks, an AIDS inflicted couple from Panama City Beach, Florida whose arrest and conviction on marijuana cultivation charges in 1990 would catapult them to "60 Minutes" fame and inspire the Marijuana AIDS Research Service (MARS) that revealed the intransigence of the U.S. federal government and inspired the campaign for Prop 215; and Elizabeth Brice, a middle-aged mother of two from Leeds, England with multiple sclerosis whose media efforts attracted the attention of Dr. Geoffrey Guy of GW Pharmaceuticals and inspired the first government approved, cannabis derived medication in the modern age.
These activists, and many more, built the pressure that created today's climate and continues to inspire activists throughout the world. Throughout it all the media has been a critical partner in driving the story. This is an historical presentation provided by Robert Randall's widow, Alice O'Leary Randall, who knew each of these individuals and provides a unique perspective on this topic.

**Topic Areas**
Others
**Submission Format**
Oral

## 7.1 Medical and Clinical Research
Adverse Effects

### Subjective Adverse Effects by Method of Cannabis Administration

**Authors**
Ms. Raeghan Mueller - University of Colorado Boulder
Dr. Leah Hitchcock - University of Colorado Boulder
Mr. Parker Gross - University of Colorado Boulder
Dr. Kent Hutchison - University of Colorado Boulder
Dr. Cinnamon Bidwell - University of Colorado Boulder

**Abstract**
**Introduction:** As legal access to cannabis has expanded at the state level, THC potency has increased significantly with reports estimating flower around 35% THC and concentrated cannabis up to 90%. These forms of cannabis can be administered in a variety of ways, and how various administration methods influence the subjective experience of cannabis is still unknown. This project investigates whether different ways of administering cannabis flower and concentrate produce different negative drug effects acutely.
**Methods:** Recreational users were asked to use either a flower (16-24% THC) (n=57; age *M*=28.76, *SD*=8.1; 58% males) or concentrated cannabis product (70-90% THC) (n=68; age *M*=28.33, *SD*=10.36; 51% males) *ad libitum* for 5-days prior to an acute administration session in a mobile laboratory. Subjective drug effects of cannabis were assessed over three-timepoints (before, after, and 1-hour after self-administration). Repeated measures ANOVA determined differences in the adverse subjective effects between individuals using flower versus concentrates as well as differences in administration method within each cannabis form.
**Results:** Repeated measures revealed a significant quadratic interaction (*p*=.050) between the form of cannabis over time, such that individuals using flower self-reported greater adverse effects compared to those using concentrated cannabis. Within flower users, there was a main effect of method of administration (*p*=.021) such that those using a 'bong' self-reported greater adverse effects compared to those using a 'pipe' on average across time. Within concentrate users, there was a marginally significant quadratic interaction between administration method (*p*=.052) such that those using a 'glass tube' reported greater adverse effects compared to those using either a 'glass rig' or 'hash pen.'
**Conclusion:** Findings suggest that both cannabis form and administration method may influence the perceived subjective effects of cannabis. Future research is critical to help inform the public about the potential risks and harms of using different forms of legal-market cannabis.

**Topic Areas**
Adverse Effects
**Submission Format**
Oral

# Acute Effects of Concentrated Cannabis on Motor Control and Speed: Smartphone-Based Mobile Assessment

**Authors**
Dr. Leah Hitchcock - Institute of Cognitive Science, University of Colorado Boulder, CO.
Dr. Brian Tracy - Department of Health & Exercise Science, Colorado State University, Fort Collins, CO.
Dr. Cinnamon Bidwell - Department of Psychology and Neuroscience, Institute of Cognitive Science, University of Colorado Boulder, CO.

**Abstract**
**Background:** Sales of concentrated cannabis with tetrahydrocannabinol (THC) potencies up to 90% have increased drastically, sparking safety concerns after use. Yet, physical impairment after concentrate use (commonly referred to as "dabbing") has never been tested. Performance on a battery of motor functions is reported before and after dabbing, in experienced male and female users, and in the context of changing blood cannabinoid levels.
**Methods:** Cannabis users (N=68, Female: 47%, Average dabbing days/month: 17.10±1.35) were assessed in a mobile laboratory before, immediately after, and 1-hour after ad-libitum concentrate use [potency of 70% (N=35) or 90% THC (N=33)]. Blood levels of THC, THC-COOH, and THC-OH were collected via venipuncture at corresponding timepoints. Whole body sway (balance), finger tapping rate, and arm punch and leg withdrawal peak acceleration and reaction times were assessed using a novel method design, publicly available smartphone application, and iPod attached to the table, wrist, or ankle of the participant.
**Results:** Concentrate use decreased balance and arm punching acceleration immediately and leg withdrawal acceleration and finger tapping rate 1-hour later ($ps \leq 0.05$). These acute dabbing effects were similar between males and females and between participants using concentrates with 70 and 90% THC. There was no strong association between blood cannabinoids and motor performance, despite changes in blood THC after dabbing.
**Conclusions:** Dabbing immediately impairs balance and arm speed and leg and tapping speed at a slower rate, with little to no reliable interaction by sex or concentrate potency, or correlation to blood levels. Potential factors contributing to these cannabis-induced motor impairments will be elucidated in future research. Results encourage further investigation into the impacts of concentrates to physically demanding work situations and roadside testing and driving, among other public health applications.

**Topic Areas**
Adverse Effects, Cannabis Interventions for Neurological Symptoms: The Way Forward, Others
**Submission Format**
Oral

# Motives Matter: Marijuana Use Motives Moderate the Links between Stress and Negative Affect

**Authors**
Mr. Nicholas Glodosky - Washington State University
Ms. Amanda Stueber - Washington State University
Ms. Emily LaFrance - Washington State University
Mr. Dakota Mauzay - Washington State University
Dr. Carrie Cuttler - Washington State University

**Abstract**
Young adults in the United States report high levels of stress, which is known to contribute to depression and anxiety. Regular cannabis users frequently cite coping with stress and negative affect as their primary reason for using cannabis. However, research indicates that coping motives are associated with potentially negative outcomes, including cannabis-related problems and negative affect. Indeed, emerging evidence indicates that using cannabis to cope with stress and negative affect may be maladaptive as it may exacerbate the same problems that users are trying to ameliorate. We therefore sought to investigate whether coping motives, or other cannabis use motives, moderate the associations between stress and negative affect. A sample of 988 cannabis-using college students completed an anonymous online survey containing measures of cannabis use, cannabis use motives, stress, depression, and anxiety. Correlation analyses revealed significant positive relationships between stress, depression, anxiety, and each of the various motives for cannabis use. Moderation analyses using Haye's PROCESS macro for SPSS indicated that coping motives was a significant moderator of the relationship between stress and depression, even after controlling for anxiety. In contrast, expansion and conformity motives were significant moderators of the relationship between stress and anxiety, after controlling for depression. Therefore, while cannabis may provide temporary relief from symptoms of stress, depression, and anxiety, using cannabis specifically to cope may potentiate the link between stress and depression, and use of cannabis for expansion and conformity may exacerbate the link between stress and anxiety. These findings contribute to emerging evidence demonstrating that cannabis use motives are important to consider and that different motives for cannabis use may predict disparate outcomes. Specifically, using cannabis to cope may exacerbate, rather than ameliorate, the potential effects of stress on depression, while using cannabis for expansion or conformity motives may compound the effects of stress on anxiety.

**Topic Areas**
Adverse Effects, Others
**Submission Format**
Poster

## Over-Baked: Adverse Reactions to Cannabis

**Authors**
Ms. Amanda Stueber - Washington State University
Ms. Emily LaFrance - Washington State University
Mr. Nicholas Glodosky - Washing
Mr. Dakota Mauzay - Washington State University
Dr. Carrie Cuttler - Washington State University

**Abstract**
Recent trends toward legalizing cannabis in North America may increase cannabis use among novice users who could have limited knowledge of possible adverse reactions to cannabis. Two of the most well-known adverse reactions are anxiety and paranoia; however, few studies have documented the prevalence of other possible adverse reactions. Consequently, we currently have a limited ability to predict who may be at a higher risk of experiencing and being distressed by negative effects of cannabis.
This study was designed to assess the prevalence of, and levels of distress produced by, various adverse reactions to cannabis, and also to explore predictors of these reactions. For this study, a measure of adverse reactions to cannabis (Adverse Reactions Scale [ARS]) was created. This measure includes 28 possible adverse reactions as well as measures of the level of distress produced by each reaction. The ARS was administered to 999 undergraduate student cannabis users in addition to measures of cannabis consumption, cannabis use motives, cannabis use disorder symptoms, personality, and negative affect. The most common adverse reactions reported were coughing fits (62.2% reported experiencing this reaction), anxiety (53.2%), and paranoia (50.3%). Panic attacks, fainting, and vomiting were rated as the most distressing reactions. Furthermore, multiple regression analyses revealed symptoms of cannabis use disorder, conformity motives, agreeableness, and anxiety sensitivity each accounted for a significant portion of unique variance in the number of different adverse reactions to cannabis experienced. Additionally, lower frequency of cannabis use predicted increased frequency of adverse reactions to cannabis. Finally, cannabis use disorder symptoms, conformity motives, conscientiousness, and anxiety sensitivity were all significant predictors of levels of distress produced by adverse reactions to cannabis. This study has important implications for novice cannabis users, healthcare professionals working with cannabis users, and budtenders making recommendations to novice users.

**Topic Areas**
Adverse Effects
**Submission Format**
Poster

## The Effects of Medicinal Cannabis Use on Adults With Medically Refractory Epilepsy: a Progress Report

**Authors**
Dr. Barbara Brett - CSU-Pueblo

**Abstract**
Approximately 3.4 million people in the US currently have active epilepsy. For approximately 30% of these individuals, antiepileptic drugs (AEDs) fail to control seizures. This condition, called medically refractory epilepsy (MRE), significantly impacts a persons' quality of life. Research in humans and animals suggests that two cannabinoids – THC and CBD – may positively affect seizures. In addition, recent randomized control trials (RCTs) confirmed the effectiveness of oral CBD as a treatment for seizures in Dravet Syndrome and Lennox Gastaut Syndrome. This preliminary observational study, funded by the ICR, examines the effects of medicinal cannabis use on seizures and behavior in adults with MRE who elect to use cannabis as an adjunctive treatment. Participants in this study are followed for one month prior to adding cannabis to their treatment regime and for five months after. No cannabis is provided to the participants. Support for the participants medicinal cannabis use is provided by the *Realm of Caring*. Most participants choose to use Charlotte's Web hemp-based CBD oil. For this study, participants wear a wireless physiological recording device daily, that measures electrodermal activity, blood pulse volume, motion/acceleration, and temperature. This data is then processed by *Empatica* to produce monthly seizure reports. In addition, three times during the course of this study, participants fill out questionnaires assessing quality of life, seizure severity, anxiety/depression, side effects, and adverse events. Participants also provide urine samples that are processed by *iC42* for cannabinoid levels. To date, 20 participants (10 men, 10 women) with a variety of MRE diagnoses have been enrolled in this study. Six of these participants are currently enrolled. Not all participants have been able to complete the study. Seizure reports and behavioral data collected thus far will be presented. Limitations of the study and lessons learned will also be addressed.

**Topic Areas**
Cannabis Interventions for Neurological Symptoms: The Way Forward
**Submission Format**
Oral

# Safety and Efficacy of Medical Cannabis to Treat Autism Spectrum Disorder Compared to Commonly Used Medications

**Authors**
Dr. Richard Holdman - CDPHE
Ms. Elyse Contreras - CDPHE

**Abstract**
***Objective***: The objective of this study was to evaluate the safety and efficacy of commonly used medications to treat Autism Spectrum Disorder (ASD) and compare this to what current research has shown regarding medical cannabis use in this population

***Methods***: Searches were performed to collect information surrounding currently used medications and their safety and efficacy profiles, biologic plausibility of cannabis use in ASD, and studies detailing cannabis' safety and efficacy profile for use in the ASD population. Results were used to compare medications to cannabis as a proposed treatment.

***Results***: The heterogeneity of ASD produces great difficulties in finding appropriate treatment, leading to many medication changes or treatment trials throughout a patient's life. Common medications prescribed all display varying levels of efficacy, safety, and tolerability between patients and symptoms targeted. Some of the most common side effects cited are also considered the most troubling symptoms associated with ASD; aggression, anxiety, irritability, and a negative effect on cognition, leading to many patients discontinuing use due to side effects outweighing benefits. Recent case reports and retrospective studies have displayed the potential efficacy, safety, and tolerability of CBD-rich medical cannabis use for treating both core symptoms of ASD and many comorbid symptoms such as irritability and sleep problems. Studies have also identified circulating endocannabinoids as a possible biomarker for ASD, providing another possible method of diagnosis.

***Conclusions***: Most commonly prescribed medications to treat symptoms of ASD display varying levels of efficacy, safety, and tolerability among the heterogeneous ASD population. CBD-rich medical cannabis seems to be an effective, tolerable, and relatively safe treatment option for many symptoms associated with ASD.

**Topic Areas**
Cannabis Interventions for Neurological Symptoms: The Way Forward
**Submission Format**
Oral

## Cannabis: Adverse Allergic, Immunologic, & Respiratory Correlates

**Authors**
Dr. William Silvers - University of Colorado School of Medicine
Dr. Ajay Nayak - Thomas Jefferson University

**Abstract**
Reports of adverse allergic reactions to *Cannabis sativa* have been emerging in the last decade. More recently, the immunologic cross-reactivity and respiratory adverse reactions have also been recognized, particularly in states with increased access to marijuana for medicinal and recreational use.
Currently, the circumstances under which sensitization to *Cannabis* occurs can be diverse but not uniform and general understanding is lacking. Further, symptomatic users present diverse symptoms including rhinitis, asthma, contact dermatitis, urticaria, and anaphylaxis (rarely). Although atopic individuals are at risk of developing allergic reaction to *Cannabis*, there have been reports of previously non-atopic individuals developing allergic reactions to *Cannabis*. In Europe, *Can s* 3 (major allergens of *C. sativa*) reportedly cross-sensitizes towards other ns-LTPs (non-specific lipid transfer proteins) from plant food sources, not been validated in North American cohorts.
*Cannabis* allergies have been reported in occupational settings. Although direct exposure to plant material over extended durations could be driver of occupational allergies to *Cannabis*, the issue is not widespread and specific allergens remain unknown.
We will review the current understanding of allergic, immunologic, and respiratory adverse reactions with case presentations and epidemiologic updates, including EVALI, e-cigarette vaping associated lung injury. Given this growing public health concern and new challenges constantly evolving, it is essential to take cognizance of health issues related Cannabis exposures.
References:
1. Silvers WS, Bernard T: The Spectrum and Prevalence of Reactions to Marijuana in a Colorado Allergy Practice. Ann Allergy Asthma Immunol. 2017; 119:570-71
2. Nayak AP, Green BJ, Sussman GL, Beezhold DH. Allergenicity to *Cannabis sativa L.* and methods to assess personal exposure. In *Cannabis sativa L. Botany and Biotechnology*. *Eds*: Chandra S, Lata H, ElSohly M. 2017.
Funding: Supported in part by National Institute of Allergy and Infectious Diseases (NIAID/NIH) Grant R21AI140411 to AN.

**Topic Areas**
Cannabis: Allergy Respiratory Immunology Correlates
**Submission Format**
Oral

## How does CBD Modulate Learning and Memory in Humans?

**Authors**
Mr. Alfredo Vargas - Colorado State University-Pueblo
Ms. Jordan Lafebre - Colorado State University-Pueblo
Ms. Lavinia Bispo - Colorado State University-Pueblo
Ms. Hanna Gebregzi - Colorado State University-Pueblo
Dr. Libby Stuyt - Crossroads Turning Point
Prof. Jeffrey P. Smith - Colorado State University-Pueblo
Prof. Moussa Diawara - Colorado State University-Pueblo

**Abstract**
Tetrahydrocannabinol (THC) and Cannabidiol (CBD) are the two main forms of cannabinoids found in cannabis. Marijuana has high content of THC, while hemp has high content of CBD. CBD lacks the intoxicating (high) effect associated with THC. CBD is known to stimulate receptors that have modulatory effects on learning and memory (L&M). There is evidence that CBD helped alleviate memory impairments caused by THC when administered together in humans. Upregulation of L&M processes could be beneficial for the general public. These findings point to CBD as a potential memory-enhancing agent. We **hypothesize** that CBD is a positive modulator of human L&M. **Objective:** Our broad objective is to examine the real-life impact of CBD on human L&M in isolation from other confounding factors (i.e., gender, age, race, drug interactions, or particular pre-existing conditions). **Design:** 200 healthy human volunteers will be recruited from the Front Rage in Colorado, to participate in a double-blind study, in which the L&M for each subject will be tested after administration of CBD or placebo. Urine samples will be collected before administration of CBD or placebo and analyzed for the presence of various chemicals to score for the potential drug interactions. Learning and memory tests will include the Rey Auditory Learning Task Revised (RAVLT-R) and the Logical Memory Subtest of the Wechsler Memory Scale (WMS-IV). The memory tests will be replicated a week later in a reverse order to minimize placebo effect. Data will be analyzed using Tukey tests and a two-way ANOVA.

**Topic Areas**
Cannabis Interventions for Neurological Symptoms: The Way Forward, Drug-Drug Interaction (Case Study)
**Submission Format**
Poster

## Impact of Marijuana Use on the Gut Microbiome in Relation to Overall Anxiety Levels

**Authors**
Mr. Jerry Ma - University of Colorado Boulder
Mr. Nicholas Gonyea - University of Colorado Boulder
Dr. Jarrod Ellingson - University of Colorado Boulder
Ms. Renee Martin-Willett - University of Colorado Boulder
Prof. Cinnamon Bidwell - University of Colorado Boulder

**Abstract**
Current literature on the human gut microbiome is focused on teasing apart the relationship between our bodies and our ecological community of commensal, symbiotic, and pathogenic gut microorganisms. Although there are many studies that relate our gut microbiota composition to a variety of subjects like anxiety, obesity, and other chronic diseases, there is little data on the effects of Cannabis use and gut health. Importantly, with the legalization of Cannabis in nine states for recreational use, the need to explore the effects of Cannabis on areas such as mental and gut health are needed now more than ever. The effects of overall anxiety levels in relation to Gut Microbiota was derived from a parent study. The parent study recruits' participants with anxiety and either have experience with Cannabis or would like to use Cannabis to treat their anxiety. Study participants are asked to choose a cannabis product that contains only THC, THC/CBD combinations, or CBD alone to treat their anxiety. Additionally, participants blood THC/CBD levels are monitored over 4 weeks to verify use. The microbiome collection explores the underlying biological mechanisms of anxiety and cannabis use. Stool samples were collected for microbial DNA sequencing at a partner lab to determine gut microbiota composition. After the raw data was returned, individual samples were analyzed using the open source software Quantitative Insights into Microbial Ecology to extract microbial phylogenetic data. Participants were then sorted into three groups based on their blood THC/CBD levels. The microbial phylogenetic data from each group was then compared to changes in their Beck Anxiety Inventory. Results suggested a relationship between the detected Gut Microbiota and the change in overall Anxiety Levels with a P-value of 0.0416. It is hoped that this study will serve as more insight into the relationship between the gut and mental health.

**Topic Areas**
Genetics of the Human-Cannabis Relationship, Immune Function, Neurodegenerative And Cardiovascular Disorders
**Submission Format**
Poster

## 7.4 Medical and Clinical Research
Immune Function, Neurodegenerative and Cardiovascular Disorders

# The Effects of Cannabidiol on Abnormal Proliferation and Inflammation in Human Rheumatoid Arthritis Fibroblast-like Synoviocytes and Triple Negative Breast Cancer Cells

**Authors**
Ms. Yoongyeong Lee - Konkuk University
Dr. Sanghyuck Park - Institute of Cannabis Research
Dr. Kyungho Lee - Konkuk University

**Abstract**
Both Rheumatoid arthritis (RA) and triple negative breast cancer (TNBC) are characterized by abnormal proliferation and an association with an affected immune response. Abnormal proliferation and inflammation disrupt endoplasmic reticulum (ER) homeostasis and induce the unfolded protein response (UPR). Since the UPR is associated with the pathogenesis of various human diseases including autoimmune diseases, neurodegenerative disease and cancer, the UPR could be served as a favorable therapeutic target for treatment of RA and cancer. Cannabidiol (CBD), the major non-psychoactive plant-derived cannabinoid, is known to reduce inflammation and proliferation of cancer cells. It also induces expression of CHOP, one of the ER stress markers. Therefore, in this study we investigated the roles of CBD on abnormal proliferation and inflammation in human RA-FLSs and TNBC cells. The effects of CBD on various phenotypes such as abnormal proliferation, apoptosis, chemo-resistance, defected UPR, and cytokine production will be presented. Understanding the underlying working mechanism of the UPR and CBD in those phenotypes will clearly increase a potential use of CBD as a therapeutic agent for the treatment of RA and breast cancer.

**Topic Areas**
Immune Function, Neurodegenerative And Cardiovascular Disorders, Physiological Conditions (Cancer, MS, Huntington, Alzheimer, Parkinson, Ulcerative Colitis, And Aging)
**Submission Format**
Oral

## Short- and Long-term Effects of Cannabis on Post-Traumatic Stress Disorder

**Authors**
Ms. Emily LaFrance - Washington State University
Dr. Carrie Cuttler - Washington State University

**Abstract**
*Background:* Cannabis is commonly used by individuals with Post-Traumatic Stress Disorder (PTSD), and there is evidence that cannabis can relieve PTSD symptoms. However, little research has explored potential predictors of the effects of cannabis on PTSD, or the long-term consequences of cannabis use for PTSD.
*Purpose:* The purpose of the study was to: 1) examine the influence of gender, type of cannabis (concentrates, flower), cannabinoid content (%THC, CBD), and dose on the acute effects of cannabis on PTSD symptoms, and 2) assess changes in dose and pre-cannabis use symptom severity over time/cannabis use sessions.
*Methods:* Longitudinal data from 17,715 cannabis use sessions reported by 554 medical cannabis users with PTSD were obtained from the app Strainprint™. Latent Change Score models were used to assess changes in PTSD symptom severity (flashbacks, intrusions, irritability, anxiety) and predictors of those changes. Longitudinal Multilevel models were used to assess changes in dose and baseline symptom severity over time.
*Results:* Severity of all four PTSD symptoms was reduced by over 50% following cannabis use, with higher doses producing greater relief from intrusive thoughts and anxiety. No gender differences, and no effects of cannabis type or content were revealed. Finally, no significant changes in pre-cannabis use symptom severity, or dose of cannabis used over time were detected.
*Implications:* Medical cannabis users reported that cannabis reduces PTSD symptoms by over 50%. Furthermore, there was no evidence of tolerance to these effects; the efficacy of cannabis in reducing these symptoms did not change over time, and users did not need to increase their doses of cannabis over time. Users also did not experience symptom exacerbation from cannabis use. These findings contribute to the literature indicating therapeutic potential for cannabis in treatment of PTSD.

**Topic Areas**
Pain, Stress, Sleep And Psychiatric Disorders
**Submission Format**
Oral

## Short- and Long-Term Effects of Cannabis on Headache and Migraine

**Authors**
Dr. Carrie Cuttler - Washington State University
Dr. Alexander Spradlin - Washington State University
Dr. Michael Cleveland - Washington State University
Dr. Rebecca Craft - Washington State University

**Abstract**
Use of cannabis to alleviate headache and migraine is common, yet research on its effectiveness is sparse. One clinical trial has been conducted and it revealed that nabilone (orally administered synthetic THC) was more effective than ibuprofen in reducing headache and increasing quality of life. In contrast, almost no research has examined effects of inhaling whole plant cannabis on headache and migraine. We sought to determine whether inhaled cannabis decreases headache and migraine severity ratings as well as whether gender, type of cannabis (concentrate vs. flower), THC, CBD, THC x CBD, or dose predict changes in these ratings. Finally, we explored evidence for development of medication overuse headaches and tolerance to cannabis effects. Archival data were obtained from Strainprint™, a medical cannabis app that allows patients to track symptoms before and after using different strains and doses of cannabis. Latent change score and multilevel models were used to analyze data from 12,293 sessions in which cannabis was used to treat headache and 7,441 sessions in which cannabis was used to treat migraine. Headache and migraine ratings decreased nearly 50% from before to after cannabis use. Men reported larger reductions in headache than women and use of concentrates was associated with larger reductions in headache than use of cannabis flower. In contrast, none of the predictors significantly accounted for change in migraine severity. Baseline ratings of headache and migraine did not change across time, suggesting that cannabis is not associated with medication overuse headache. However, there was evidence of tolerance to the therapeutic effects of cannabis. Specifically, patients reported using larger doses of cannabis and achieving smaller reductions in headache and equivalent reductions in migraine over time. Collectively these results indicate that cannabis effectively reduces headache and migraine ratings, but that tolerance to these effects may develop with repeated use.

**Topic Areas**
Pain, Stress, Sleep And Psychiatric Disorders
**Submission Format**
Oral

## Chronic Cannabis-Induced Alterations in Stress Reactivity

**Authors**
Mr. Nicholas Glodosky - Washington State University
Dr. Carrie Cuttler - Washington State University
Dr. Timothy Freels - Washington State University
Dr. Ryan McLaughlin - Washington State University

**Abstract**
Cannabis users frequently cite stress relief as their primary reason for use, and cannabis intoxication does acutely reduce stress. The effects of cannabis are attributed to recruitment of the endocannabinoid system, which regulates the neuroendocrine stress response. However, despite the endocannabinoid system's regulation of the stress response, little is known about the effects of chronic cannabis use on the stress response. There is evidence of a blunted stress response in chronic cannabis users, suggesting that cannabis may cause alterations in hypothalamic-pituitary-adrenal (HPA) axis activation. However, it remains unclear whether these changes are caused by cannabis or rather indicate an underlying risk factor for cannabis use. The primary objective of this study is to test the effects of chronic cannabis use on basal and stress-induced stress hormone concentrations using a rodent model of cannabis vapor self-administration. 104 male and female rats were trained to respond for vaporized cannabis extract containing different concentrations of tetrahydrocannabinol (THC) or control vapor. After 30 days of self-administration, rats underwent an acute restraint stress challenge or were left undisturbed in their home cage. Blood samples were collected before stress, immediately post-stress offset, and at 30, 60, and 90 minutes post-stress. Preliminary results show that female rats and rats administering lower doses of THC exhibited the highest rates of responding for vapor rewards. We further plan to analyze blood samples to compare changes in plasma concentrations of stress-related hormones between cannabis- and vehicle-exposed rats as a function of the stress manipulation. Finally, stress-reactivity at baseline will be used to predict cannabis self-administration rates to determine whether reduced stress reactivity is related to higher levels of cannabis self-administration. Collectively, these analyses will allow us to determine whether chronic cannabis use causes a blunted stress response or whether decreased stress-reactivity is a vulnerability factor for cannabis use.

**Topic Areas**
Pain, Stress, Sleep And Psychiatric Disorders
**Submission Format**
Oral

## Initiating Clinical Trials with Cannabis Products

**Authors**
Dr. Emily Lindley - University of Colorado
Dr. Jacquelyn Bainbridge - University of Colorado School of Medicine
Dr. Heike Newman - University of Colorado Boulder

**Abstract**
There is growing evidence for the efficacy of cannabis for the treatment of various health conditions. As such, there is a concomitant increase in the number of new investigators entering the realm of cannabis-based research. Implementing clinical trials of investigational cannabis products is a complex process, particularly for researchers at institutions without prior cannabis research experience. In addition to the arduous regulatory approvals required, there are various legal and infrastructural considerations that can be challenging to navigate. The goal of this presentation is to describe how we initiated a clinical trial of vaporized cannabis at the University of Colorado and to provide suggestions for avoiding obstacles when developing new cannabis research programs.

**Topic Areas**
Pain, Stress, Sleep And Psychiatric Disorders
**Submission Format**
Oral

## Cannabis, Colorado, and the Opioid Epidemic

**Authors**
Dr. Kenneth Finn - Springs Rehabilitation, PC

**Abstract**
Colorado has had medical marijuana since 2001 and currently more than 90% of medical marijuana recommendations are for pain. In 2019, Colorado will likely have a record number of opioid drug overdoses, with nearly 24% increase between 2018 and 2019. Based on the current state of the opioid epidemic and review of the medical literature, it appears that medical use of marijuana for pain has not had any impact on the states opioid epidemic. The medical literature will be reviewed and reasons why this is will be discussed.

**Topic Areas**
Pain, Stress, Sleep And Psychiatric Disorders
**Submission Format**
Oral

## Cannabis Use and Psychological Pain

**Authors**
Dr. Karen Yescavage - Colorado State University-Pueblo
Dr. Connie McLaughlin-Miley - Independent consultant
Ms. Wendy Alfonso - Colorado State University - Pueblo
Ms. Morgan Easter - Colorado State University - Pueblo
Ms. Lara Gribble - Colorado State University - Pueblo
Mr. Nathan Hurt - Colorado State University - Pueblo
Mr. Michael Kennedy - Colorado State University - Pueblo
Ms. Frances Martin - Colorado State University - Pueblo
Mr. Jeremy Peterson - Colorado State University - Pueblo
Ms. Catherine Sebring - Colorado State University - Pueblo

**Abstract**
Preliminary results of mixed-methodology research on cannabis use and psychological pain will be discussed by principal investigators (1) Karen Yescavage, Ph.D., professor of psychology at Colorado State University-Pueblo and coordinator of the College of Humanities, Arts, and Social Sciences interdisciplinary minor in cannabis studies, and (2) Connie McLaughlin-Miley, PharmD, MBA, pharmacist and cannabinoid researcher. Quantitative data were gathered from participants via survey and qualitative data via focus group. Respondents were recruited from two locations: Pueblo, Colorado and Ann Arbor, Michigan. Before discussing preliminary findings, undergraduate students in Dr. Yescavage's cannabis research lab, who helped generate the survey and focus group questions, will discuss the empirical foundations of this original, psychological pain research. Peer-reviewed literature published within the last 5 years to be discussed (and discussed by) includes the association of cannabis and: 1. Anxiety (Catherine Sebring and Nathan Hurt), 2. PTSD (Jeremy Peterson), 3. Bipolar disorder (Frances Martin), 4. Suicidality (Lara Gribble), 5. Schizophrenia (Wendy Alfonso, B.A.), and 6. Sex Differences in these areas of psychological pain (Morgan Easter).

**Topic Areas**
Pain, Stress, Sleep And Psychiatric Disorders
**Submission Format**
Panel

# Novel task measures acute induction of and recovery from rumination in anxious population

**Authors**
Mr. Mohammad Habib - Department of Psychology and Neuroscience, University of Colorado Boulder
Dr. Leah Hitchcock - University of Colorado Boulder
Dr. Cinnamon Bidwell - Institute of Cognitive Science and Department of Psychology and Neuroscience, Univeristy of Colorado Boulder

**Abstract**
**Background:** Over 18% of the US population exhibits negative affective symptoms such as avoidance and irritability. The novel rumination induction task (RIT) aims to combine subjective self-reported feelings (SRF) with objective heart rates (HR) to create a dual-modal measurement, assessing ruminative negative affective symptoms in mobile or clinical research settings. The study aims to determine whether the RIT quickly induces measurable rumination reactions and recoveries after focused breathing exercises. Convergent validity of the RIT was assessed via comparing outcomes with the validated Depression, Anxiety, and Stress Scales (DASS).
**Methods:** Participants (N=158, $M_{age}$= 32 years, 61.4% Female) who reported experiencing a range of mild to severe anxiety completed the DASS survey and the RIT, involving participants rating their current feelings (scale from -50=worst feeling ever to 50=best feeling ever) and a HR measurement at three timepoints: Baseline (prior to any knowledge of RIT), Post-Rumination (directly after 3-minutes of rumination), and Post-Breathing (directly after 3-minutes of focused breathing).
**Results:** SRF scores were correlated across timepoints and correlated to the corresponding HR at each timepoint ($r$'s $\geq 0.276$, $p$'s $\leq 0.001$). Timepoint significantly altered SRF and HR, such that SRF decreased from Baseline to Post-Rumination and increased from Post-Rumination to Post-Breathing, while HR increased from Baseline to Post-Rumination and remained elevated at Post-Breathing ($p$'s $< 0.01$). Moreover, participants exhibiting greater baseline levels of depression on the DASS also exhibited lower SRF, with no effect on HR.
**Conclusion:** Brief rumination induction reliably decreases feelings and increases HR, while brief focused breathing recovers feelings to Baseline levels with no change in HR. The RIT quickly induces subjective negative feelings with objective heartrates, which correlate with baseline clinical metrics of negative affective symptoms. This task adds a valid, brief, and dynamic measurement of induced affect for use in acute drug administration studies and/or mobile research environments.

**Topic Areas**
Pain, Stress, Sleep And Psychiatric Disorders
**Submission Format**
Poster

# A Cross-Sectional and Prospective Comparison of Medicinal Cannabis Users and Controls on Self-Reported Health

**Authors**
Mr. Joel Munson - Realm of Caring Foundation
Mr. Nicolas Schlienz - University at Buffalo
Mr. Ryan Vandrey - Johns Hopkins University School of Medicine

**Abstract**
**Introduction**. Despite widespread legalization, the impact of medicinal cannabis use on patient-level health and quality of life has not been carefully evaluated. The objective of this study was to characterize self-reported demographics, health characteristics, quality of life, and health care utilization of Cannabis Users compared with Controls.
**Methods**. A longitudinal, cross-sectional web-based survey study was completed between April 2016 and February 2018. Participants were invited to complete assessments every 3 months. Study participants (N=1276) were a convenience sample of either patients with a diagnosed health condition or caregivers of a patient with a diagnosed health condition registered with the Realm of Caring Foundation. Assessments included self-reported demographics, healthcare utilization, medication use, pain, anxiety, depression, sleep, and quality of life (QOL). Cannabis Users (N=808) were compared with Controls (N=468) using negative binomial regression and linear mixed effect models testing the effect of initiation, cessation, and maintenance of medicinal cannabis use.
**Results**. Cannabis Users self-reported significantly better quality of life, health satisfaction, sleep, average pain severity, anxiety, and depression compared with Controls. Cannabis Users reported using fewer prescription medications and were less likely to have a past month emergency department visit or hospital admission. There were no group differences in past-month ratings of worst pain severity, over-the-counter medication, outpatient healthcare visits, or sick days. Among participants assessed at follow-up, 65% of baseline Controls initiated medicinal cannabis use and 8% of baseline Cannabis Users discontinued use. Controls who initiated cannabis use after baseline showed significant health improvements at follow-up, and the magnitude of improvement mirrored the between-groups differences observed at baseline.
**Conclusions**. Cannabis use was associated with improved health and quality of life. Longitudinal testing suggests that group differences are due to the medicinal use of cannabis. Clinical trials evaluating the efficacy of defined cannabinoid products for specific health conditions are warranted.

**Topic Areas**
Pain, Stress, Sleep And Psychiatric Disorders
**Submission Format**
Poster

## Comparison of Cannabidiol and Citalopram in targeting Fear Memory in Female Mice

**Authors**
Prof. Jeffrey P. Smith - Colorado State University-Pueblo
Ms. Amy Uhernik - CSU-Pueblo
Mr. Jose Vigil - CSU-Pueblo

**Abstract**
Anxiety disorders affect around 20%, and major depression near 10%, of the US population. Anxiety disorders and depression frequently co-occur, producing worse symptoms and treatment resistance when both are present. Women experience an increased incidence of both depression and anxiety disorders, although, research to support therapeutic options specifically for women lags behind that involving male subjects. Citalopram is a Selective Serotonin Reuptake Inhibitor (SSRI) that is prescribed to treat depression. It is also used “off-label” to treat anxiety-related disorders. Similar to all SSRIs, Citalopram produces serious side effects including various psychological and memory problems. Cannabidiol, a cannabinoid, has been suggested to have anxiolytic and anti-depressant qualities and does not appear to have major negative side effects, however, research to support its use for depression and anxiety disorders is underdeveloped. Fear learning and memory experimentation is used to model the biology of various anxiety disorders, and depression is associated with memory problems, is sometimes modeled by fear memory experimentation, and involves pathology in brain structures critical for fear learning and memory. Therefore, we used trace Pavlovian fear conditioning with female mice and compared effects of Citalopram to Cannabidiol when present during acquisition of auditory cue-associated memory, context memory, and fear generalization. We also evaluated how extinction of each of these memories varied with treatments. Behaviorally the compounds produced similar effects, however, they exclusively targeted particular domains of each memory type. This suggests particular biochemical and anatomical pathways which may be specific effectors of the behavioral modifications produced by each compound.

**Topic Areas**
Pain, Stress, Sleep And Psychiatric Disorders
**Submission Format**
Poster

# Hu-211 Sensitive, Cognitive Learning and Memory Processes Modulate Glun2b Surface Expression in the Mouse Brain

**Authors**
Prof. Jeffrey P. Smith - Colorado State University-Pueblo
Ms. Amy Uhernik - CSU
Mr. Jose Vigil - C

**Abstract**
Inhibiting the NMDA receptor GluN2B subunit in rodents blocks fear memory formation following strong but not weak, trace and delay conditioning, and trafficking of this to plasma membrane fractions of hippocampal tissue accompany both strong and weak fear conditioning. GluN2B signaling in amygdala is also important for fear memory, but unknown is whether GluN2B trafficking in amygdala is involved. Also unknown is whether fear-conditioning-dependent GluN2B trafficking occurs in neurons, or some other cell type. The requirements for strong conditioning to trigger memory dependence on GluN2B suggests that acquisition requires activity dependent-GluN2B/NMDA receptor signaling and possibly trafficking, however, this is unclear. We therefore hypothesized that neuronal GluN2B trafficking in hippocampus and amygdala depends on GluN2B function and evaluated this in mouse brain slices shortly after conditioning. We used a dual-immunostaining approach to measure changes in neuronal GluN2B surface expression in situ. We then evaluated GluN2B trafficking as a function of a weak trace fear conditioning protocol that produced a memory that was not inhibited by the selective GluN2B inhibitor threo-ifenprodil, but which was inhibited by the putative GluN2B inhibitor, HU-211. Threo-ifenprodil inhibited the increase in GluN2B surface expression, but not the memory, suggesting that trafficking was likely auto-regulatory and that trafficking was not a requirement for memory formation. Results with HU-211 were consistent with this compound targeting GluN2B by a mechanism that was different, and more functional, than that of threo-ifenprodil.

**Topic Areas**
Pain, Stress, Sleep And Psychiatric Disorders
**Submission Format**
Poster

## 7.6 Medical and Clinical Research

Physiological Conditions (Cancer, MS, Huntington, Alzheimer, Parkinson, Ulcerative Colitis, And Aging)

### Cannabis and the Treatment of Cancer: A Rational, Data-Driven Approach

**Authors**
Dr. Jordan Tishler - Independent

**Abstract**
When it comes to cancer and cannabis use there is a lot of enthusiasm, but how about data? This talk will address two hot-button issues: symptom management and tumor-directed treatment. For symptom management, related either to the tumor or to standard medical treatment, there are good data to guide our approach. We will review these data and discuss practical approaches to patient care.
A more fraught issue is using cannabis to treat the tumor itself. Patients, based on mixed sources of information, are often interested using cannabis to treat their tumor itself . We will review the data that's driving this interest for patients; discuss the difference between anecdotal and scientific evidence; and the ethics of this "very off label" use of.
Key learning objectives :
Participants will:
1) Recognize which symptoms can be addressed with cannabis2) Understand multiple approaches to medicating with cannabis3) Be prepared to answer both medical and ethical questions for patients who wish to consider using cannabis to treat their tumor4) Have a baseline approach to treating patients' tumor, in appropriate cases

**Topic Areas**
Physiological Conditions (Cancer, MS, Huntington, Alzheimer, Parkinson, Ulcerative Colitis, And Aging)
**Submission Format**
Oral

# A Randomized, Double-blind, Placebo Controlled, Parallel Study of Tolerability and Efficacy of Cannabidiol on Motor Symptoms in Parkinson Disease: Interim Report on Tolerability

**Authors**
Dr. Maureen Leehey - University of Colorado School of Medicine
Dr. Ying Liu - University of Colorado School of Medicine
Dr. Stefan Sillau - University of Colorado School of Medicine
Dr. Sarah Fischer - University of Colorado School of Medicine
Dr. Jost Klawitter - University of Colorado School of Medicine
Dr. Cristina Sempio - University of Colorado School of Medicine
Dr. Michelle Fullard - University of Colorado School of Medicine
Dr. Trevor Hawkins - University of Colorado School of Medicine
Dr. Lauren Seeberger - University of Colorado School of Medicine
Mr. Emil Diguilio - University of Colorado School of Medicine
Mr. David VU - University of Colorado School of Medicine
Ms. Sarah Baker - University of Colorado School of Medicine
Mr. Tristan Seawalt - University of Colorado School of Medicine
Dr. Grace Chin - University of Colorado School of Medicine
Dr. Jacquelyn Bainbridge - University of Colorado School of Medicine

**Abstract**
Background: Cannabis use is frequent in Parkinson disease (PD), despite limited scientific data regarding its effects. We present preliminary data on tolerability/safety of a relatively high cannabidiol (CBD) and low tetrahydrocannabinol (THC) product.

Methods: This randomized, double-blind, controlled, parallel study has two treatment arms: CBD and placebo. Active study drug is CBD cannabis extract (from National Institute of Drug Abuse) oral sesame oil solution with 100 mg/ml CBD and 3.33 mg/ml THC. Study drug started at 1.25 mg/kg/day of CBD for 3-5 days, then increased to 2.5 mg/kg/day CBD for 10-14 days. Safety/tolerability were evaluated by examining adverse events (AEs), physical exams, EKGs, safety labs, and withdrawals due to study drug intolerance.
Results: Between September 17, 2018 and November 19, 2019, 38 persons enrolled, and 32 took study drug: mean age 67.6 (SD 7.05), 22 (69%) males, disease duration 5.2 (5.91) years. Mean final dose was 2.29 (0.53) mg/kg/day. No significant changes in physical exam, safety labs and EKG occurred. One participant withdrew due to intolerance.
To evaluate AEs, unblinded study staff assigned participant data to two groups according to treatment randomization, while all blinded study staff remained blinded. Group A (n=18), reported AEs 170 times, and 15/18 (83%) reported an AE: dizziness (56%); fatigue (44%); feeling of relaxation (39%); headache, decreased concentration, somnolence (28%); nausea, confusion, feeling abnormal (22%); weakness, thinking abnormal, increased concentration, dry mouth and a fall (17%). Group B (n=14) reported AEs 70 times, and 10/14 (71%) reported an AE: feeling of relaxation, headache (29%); cough, cold, somnolence, insomnia (21%). Most AEs were mild; in Group A they occurred more at 1.25 mg/kg/day, and in Group B at 2.5 mg/kg/day. There were no serious AEs.
Conclusion: Preliminary data suggests relatively high CBD/low THC (likely Group A) is tolerated in PD, with many mild AEs.

**Topic Areas**
Physiological Conditions (Cancer, MS, Huntington, Alzheimer, Parkinson, Ulcerative Colitis, And Aging)
**Submission Format**
Oral

# Effects of Dietary Hempseed on Developmental Changes in Body Composition and Arterial Blood Pressure in Female C57BL6 Mice

**Authors**
Ms. Hailey Streff - Colorado State University-Pueblo
Mr. Derrick Williams - Colorado State University-Pueblo
Prof. Cynthia Blanton - Idaho State Univerity, Pocatello
Prof. Annette Gabaldon - Colorado State University-Pueblo

**Abstract**
Hempseed is a nutrient-rich food that may have significant health benefits. Yet, this remains an emerging research field with much left to discover. We investigated the effects of dietary hempseed on developmental changes in body composition and blood pressure in growing female C57BL6 mice. Groups ($n$ = 8 each) of mice were fed one of three diets [15% ($w$/$w$) hempseed (15HS); 5% hempseed (5HS); 0% hempseed (Control)] from age 5 to 30 weeks. Macronutrient (protein, carbohydrate, fat) proportion and energy density (kcal/g) were similar for all three diets, prepared by *Dyets, Inc*. in pelleted form and provided *ad libitum*. Body mass and food intake were measured weekly. Caudal artery blood pressure was measured bi-weekly. Body composition was measured monthly using DEXA, and included bone mineral density (BMD), bone mineral content (BMC), bone area (B area), total tissue mass (TTM), lean mass, and fat mass. Mice in all three diet groups exhibited an age-related increase in mean arterial pressure (MAP), without an influence of the hempseed diet to alter this normal developmental response. In Control mice, for example, MAP increased from 103.7 ± 5.1 mm Hg, age 5 wks, to 130.5 ± 4.3 mm Hg, age 16 wks. Soft tissue and skeletal bone growth were also not influenced by the hempseed diet from age 5 to 16 weeks. TTM increased by ~1.4-fold in all mice, mainly due to an increase in lean body mass. Skeletal tissues developed as follows: BMD (~1.4-fold increase), BMC (~2.3-fold increase), and B area (~1.6-fold increase). In conclusion, dietary hempseed supplementation does not appear to alter the normal developmental changes in body composition and blood pressure in female C57BL6 mice. The data provide an important baseline moving forward with future studies on the potential health benefits of dietary hempseed using the C57BL6 mouse as an animal model.

**Topic Areas**
Physiological Conditions (Cancer, MS, Huntington, Alzheimer, Parkinson, Ulcerative Colitis, And Aging)
**Submission Format**
Poster

## 7.7 Medical and Clinical Research
Other

### Cannabis Attitudes and Knowledge Are Associated With Cannabis Use in a Population-based Survey of Active Adult Athletes

**Authors**
Dr. Joanna Zeiger - Canna Research Group
Dr. William Silvers - Canna Research Group, Boulder, CO; Univserity of Colorado School of Medicine, Aurora, CO
Dr. Edward Fleegler - To Life In Peace, LLC; Canna Research Group
Dr. Robert Zeiger - Kaiser Permanente Southern California; Canna Research Group

**Abstract**
With mounting evidence for medicinal efficacy of cannabis for a variety of conditions, it is important to better understand the inter-relatedness between cannabis knowledge, attitudes, and behavior in order to target educational initiatives. This secondary analysis of The Athlete Pain, Exercise, and Cannabis Experience (PEACE) Survey (n=1,161) a cross-sectional survey study in active adult athletes, aimed to determine whether cannabis attitudes mediated the relationship between cannabis knowledge and use. The primary sports were running, triathlon, cycling, and other. Cannabis knowledge was evaluated with four questions; cannabis attitudes were assessed with 11 questions which were used in the SPSS TwoStep Cluster procedure to assign group membership by attitudes. Chi-square was used to evaluate whether demographics and cannabis knowledge differed by attitudes clusters. Regression analysis evaluated whether cannabis knowledge and attitudes were associated with cannabis use (i.e. never user, past user, current user) and if attitudes mediated the relationship between knowledge and use. A three-cluster solution was the best fit to the attitudes data: Conservative (n=374, 32.2%), Unsure (n=533, 45.9%), and Liberal (n=254, 21.9%). There was a significant difference between the attitude's clusters for all 11 items (all $p<0.001$). Knowledge was significantly associated with attitudes ($p<0.001$) and use ($p<0.001$) and attitudes were associated with use ($p<0.001$). Liberal athletes tended to be younger ($p<0.001$), in the "other" sport category ($p<0.05$), had the most knowledge about cannabis ($p<0.001$), and were more often current cannabis users ($p<0.001$). Attitudes significantly mediated the relationship between cannabis knowledge and use (indirect effect: 0.08, 95% CI: 0.06-0.09). Liberal athletes showed better knowledge and tended to be current users more often than Conservative or Unsure athletes. Education regarding cannabis needs to take into consideration knowledge and attitudes about cannabis, especially in a medical setting.

**Topic Areas**
Others
**Submission Format**
Oral

**An Observational Study Evaluating Pharmacogenomic Variation to Identify Factors With Potential Impact on Efficacy and Safety of Medical Marijuana: Preliminary Results**

**Authors**
Dr. Michelle Shuffett - Independent consultant
Ms. Ragan Hart - Independent consultant
Ms. Alexandra DeKinder - Columbia Care Inc.
Dr. Rosemary Mazanet - Columbia Care Inc.

**Abstract**
Legal use of medical marijuana (MM) is becoming more integrated into medical practice, with the number of state-based qualifying conditions (QCs) continuously growing. Despite this, there is limited evidence on how to safely/effectively dose MM products. Evaluation of product use identifies “high daily dose users” or “low daily dose users”, with both groups assumed to have similar efficacy and product satisfaction. This variation in total cannabinoid daily dose (TCDD) exposure motivated this investigation to identify demographic features and pharmacogenomic factors that may affect the perceived efficacy/safety of MM.

Participants were recruited from Columbia Care dispensaries in New York (N=158), with a purchased product history for a minimum of three consecutive encounters across a six-month period. TCDD was categorized into 3 groups (high: 50 mg, reference: 11-49 mg, low: 10 mg). Saliva samples were sent for genotyping using the Axiom Precision Medicine Research array. A Qualtrics survey was administered at sample collection.

Population included 60% Females, 40% Males; mean age 52 (range: 23-87) and 51 (range: 18-79), respectively. The top three QCs were Chronic Pain (60%), Neuropathy (18%), and PTSD (13%). Other conditions (less than 1% per condition) included: Epilepsy, HIV/AIDS, Huntington’s Disease, Inflammatory Bowel Disease, Multiple Sclerosis, Opioid Reduction, Parkinson’s Disease, and Spinal Cord Injury (with spasticity). Study demographics are similar to a recent analysis by Boehnke et al of available state-based registry statistics that found Chronic Pain, Multiple Sclerosis (with spasticity), Chemotherapy-induced Nausea and Vomiting, and PTSD among the most common QCs for US medical marijuana license holders.

Ongoing analyses of these data are evaluating variance within/among the TCDD groups regarding self-reported symptom relief as well as the pharmacogenomic associations of TCDD group and symptom relief. The purpose of these analyses is to provide insights that will tailor dosing recommendations to an individual patient’s needs.

**Topic Areas**
Others
**Submission Format**
Oral

# The Potential of Whole Hemp Seed as a Prebiotic to Support Growth and Metabolism of Anticarcinogenic Probiotic Bacteria In Vitro

**Authors**
Mrs. Whitney Lujan - Colorado State University-Pueblo
Prof. Annette Gabaldon - Colorado State University-Pueblo
Ms. Krystal Hrbac - Colorado State University-Pueblo

**Abstract**
This study tested the hypothesis that whole hemp seed supports growth and metabolism of *Lactobacillus plantarum* ATCC 8014 and *Lactobacillus fermentum* NCIMB 5221. These probiotic bacteria were selected because of their ability to produce fermentation metabolites, such as lactic acid (LA) and short chain fatty acids (SCFAs), with known anti-cancer effects. However, nothing is known about dietary hemp seed fermentation by these probiotics. Hemp seeds are rich in lipids, proteins, and fiber, suggesting that they are fermentable and capable of supporting probiotic growth and metabolism. To test this hypothesis, each bacterium was grown in vitro in a batch culture system under anaerobic conditions in a glucose deficient MRS liquid broth media containing whole hemp seed powder (1% and 5% concentrations, w:v). The positive controls for the study were 1% inulin (a fermentable resistant starch and fructooligosaccharide) and glucose (a readily fermentable monosaccharide), while the negative control was the basal medium (without added glucose or meat extract). The data support the hypothesis. Both probiotics grew well in the 5% hemp seed medium, exhibiting growth curves that most closely resembled those for glucose (vs. all other treatment groups), and demonstrated some capacity to produce acidic metabolites, as evidenced by a decrease in pH of the batch culture medium. Probiotic fermentation of 5% hemp seed also yielded small increases in LA and SCFA concentrations in the batch culture medium, and perhaps with higher hemp seed concentrations (> 5%) and/or with extended fermentation time (> 24 hours), yields of these anti-cancer metabolites might have been even greater. In conclusion, hemp seed appears to be a promising dietary aide which may promote growth and diversity of probiotic bacteria in the colon and encourage synthesis of bioactive metabolites.

**Topic Areas**
Others
**Submission Format**
Poster

## 8. Non-medical (Industrial) Hemp

### Rheological Characteristics of Hemp Fiber/PLA Composites for Fused Filament Fabrication

**Authors**
Prof. Nebojsa Jaksic - Colorado State University-Pueblo
Prof. Mel Druelinger - Colorado State University-Pueblo
Mr. Akhter Zia - Colorado State University-Pueblo

**Abstract**
Fused filament fabrication (FFF) is an additive manufacturing process (3D printing) where a molten thermoplastic filament extruded through a small-diameter nozzle “prints” an object layer by layer. The most often used thermoplastic is polylactic acid (PLA), a bio-compostable polymer. Since this polymer is not strong enough for many load-bearing applications, various reinforcing agents (carbon fiber, sawdust, hemp, etc.) were introduced and commercialized. However, the filaments’ mechanical characteristics of such composites are not well documented. In addition, the flow of molten composite through a small-diameter printing nozzle (0.4 mm) can be easily impeded if the filler particles are too large. Thus, the viscosity characteristics of composites are important factors in designing a proper filament for FFF. Rheology is the science of flow of liquids and gasses as well as the time dependence of deformation of solids. Rheometers measure viscosity and viscoelasticity. In general, viscosity is resistance to flow and can be defined as the ratio of shear stress to shear rate. Viscoelasticity is property of some materials that simultaneously exhibit time-independent elastic properties as well as time-dependent viscous properties. Many polymers are viscoelastic and non-Newtonian, so their rheological characteristics have to be determined by experiments.
In order to characterize FFF filament with various hemp-to-PLA ratios and various sizes of hemp fibers there is a need to determine the filament’s rheological characteristics before (for reliable extrusion of the filament through the printing nozzle) and after the FFF process (for material recycling). In this work, a number of experiments are conducted using a rheometer to determine rheological characteristics of the hemp-based composites. The results presented show rheological characteristics using the following process variables: FFF process stage (before and after), hemp-to-PLA ratio (10-40% of hemp fibers), hemp fiber type (bast or hurd), fibers’ size/shape (about 0.4 mm), and temperature (50 ºC to 250 ºC).

**Topic Areas**
Industrial Applications (E.G., Paper, Yarn, Textiles, Etc.)
**Submission Format**
Oral

# Methods of Extraction of Biopolymers from Hemp Biomass and Production of Electrospun Nanofibers from Extracted Materials

**Authors**
Mr. Jacob Mutz - Colorado State University - Pueblo
Mr. Benjamin Highfill - Colorado State University - Pueblo
Mr. Guy Mendel - Colorado State University - Pueblo
Dr. Richard Farrer - Colorado State University - Pueblo

**Abstract**
The primary components of industrial hemp are a set of biopolymers that are responsible for the structure and strength of the plant from stalk to leaves. Cellulose, lignin, hemicellulose, and pectin are the four biopolymers that make up the majority of the hemp plant material. While the combination and interactions of these biopolymers produce the structure of most plant material, each have unique physical and chemical characteristics that are worth exploring. Because of the strong interactions that exist between the biopolymers within the plant, extraction and separation of the polymers tends to damage (change physically and chemically) some or all of the individual molecules. Our interest lies with expanding the products that can be developed from hemp and its derivatives. Therefore, the primary aim of this research is the production of nanofibers from biopolymers extracted from hemp biomass. The driving force of the project is the development of low-cost and environmentally friendly process for both extraction and fiber production. This presentation will cover the work that has been completed on both sides of the project: (1) extraction and purification of the biopolymers, and (2) production of nanofibers from the extracted materials.

**Topic Areas**
Industrial Applications (E.G., Paper, Yarn, Textiles, Etc.), Others
**Submission Format**
Oral

# Extraction of Cellulose from Hemp Biomass for the Production of Electrospun Nanofibers

**Authors**
Mr. Guy Mendel - Colorado State University - Pueblo
Mr. Benjamin Highfill - Colorado State University - Pueblo
Mr. Jacob Mutz - Colorado State University - Pueblo
Dr. Richard Farrer - Colorado State University - Pueblo

**Abstract**
The 2018 Farm Bill removed the Schedule 1 controlled substances label from hemp and designated it as an ordinary agricultural commodity. As a result, 46 states (excluding Idaho, Mississippi, New Hampshire, and South Dakota) have developed regulations that allow for the cultivation of hemp at some level (commercial, research, and/or pilot). Hemp provides three main products: oils, seeds, and fibers. The fibrous materials have a variety of uses, from animal feed to textiles, insulation, and building materials. Hemp biomass is primarily composed of a mixture of cellulose, lignin, hemicellulose, and pectin. These biopolymers are responsible for the strength and structure of the hemp plants, and each of the biopolymers have unique physical and chemical properties. Cellulose is a linear polymer consisting of repeating glucose units, which result in the presence of repeating hydroxyl moieties along the length of the polymer. Therefore, strong hydrogen-bonding interactions exist between adjacent strands of cellulose. Because of these favorable interactions, large bundles consisting of many interacting chains of cellulose are produced in plants. The focus of the presented work is the extraction of pure cellulose from hemp biomass and the production of electrospun nanofibers from the extracted cellulose. A primary aim of this work is the extraction and fiber production must be accomplished using relatively mild chemicals and conditions, and that the chemicals employed be as inexpensive and environmentally friendly as possible. The desire is to develop processes to extend the use of hemp in order to determine if hemp can be a financially viable agricultural crop.

**Topic Areas**
Industrial Applications (E.G., Paper, Yarn, Textiles, Etc.), Others
**Submission Format**
Poster

# The Creation of Electrospun Nanofibers Derived from Lignin and Cellulose Extracted from Hemp Biomass Using Deep Eutectic Solvents

**Authors**
Mr. Jacob Mutz - Colorado State University - Pueblo
Mr. Guy Mendel - Colorado State University - Pueblo
Mr. Benjamin Highfill - Colorado State University - Pueblo
Dr. Richard Farrer - Colorado State University - Pueblo

**Abstract**
The major biopolymers from plants, lignin and cellulose, possesses many qualities whose potential has not been fully explored. Giving valor to the materials can bring about use for all plant biomass as well as waste from industrial processes. In this research, we demonstrate the different processes for independently extracting lignin and cellulose from industrial hemp with a specific focus on reusable deep eutectic solvents as extraction solvents. We also report our work on creating electrospun nanofibers from the extracted lignin and cellulose with focus on the properties of the fibers and considerations for their applications.

**Topic Areas**
Industrial Applications (E.G., Paper, Yarn, Textiles, Etc.), Others
**Submission Format**
Poster

## 9. Public Health and Education

### Werehab: a Mobile Application to Help Cannabis Rehabilitation

**Authors**
Dr. Yoanna Long - Colorado State University-Pueblo
Dr. Kuang-Yuan Huang - Colorado State University-Pueblo
Ms. Xiao Cui - Colorado State University-Pueblo
Mr. Michael Zamora - Colorado State University-Pueblo
Mr. David Lichliter - Colorado State University-Pueblo

**Abstract**
This research project, funded by the Institute of Cannabis Research (ICR), aims to develop a mobile application to help cannabis rehabilitation. The project includes two main stages. Stage one is an empirical study while stage two applied the results of stage one to develop a mobile application to assist cannabis rehabilitation.
The purpose of the first stage is to understand cannabis rehabilitation support group in a social network (Internet-based) setting and also to explore the factors impacting individual rehabilitation behavior. An online discussion forum (cannabisrehab.org) was chosen as the research setting and six major threads that includes approximately one thousand messages were downloaded as the research database. For each thread, the thread initiator (the person who started the thread) normally posts messages regarding his or her own experience overcoming cannabis addiction while the rest of the participants replied to share information and/or show support. Two major types of support were investigated including both informational support (sharing the experience of certain medication to cure some symptom) and emotional support (showing sympathy and encouragement). The results indicate that first, the initiators' emotion is greatly impacted by the occurrence of replies and second, both informational and emotional support positively affect initiators' emotions.
Based on the results from stage one, the purpose of stage two is to develop a mobile application to offer both informational and emotional support to cannabis rehabilitators. The major functions of the application include but are not limited to information sharing (such as rehabilitation resources, questions and answers, and periodical digest on the most recent rehabilitation articles) and emotional support (such as coaching, goal setting and progress checking, and possibly computer bots).

**Topic Areas**
Big Data
**Submission Format**
Oral

# How to Make the Most Optimal Rules for Governing the Hemp Industry and Avoid Bureaucratic Dictatorship

**Authors**
Dr. Cindy Phillips - Hemp Analytics

**Abstract**
Which set of rules would lead the hemp industry to the most prosperity while correctly balancing competing objectives, such as protecting the public's health and stopping criminal behavior? This question sets the stage for a further question: What is the most optimal decision-process to obtain the most optimal rules for governing the hemp industry? My research examines the traditional bureaucratic decision-making process, such as the one that the USDA used to create the interim hemp rules versus a decision-making process that uses insights from collective intelligence research. In this talk, I provide arguments and evidence that the USDA's interim hemp rules risk creating a problem that I call "bureaucratic dictatorship", which leads to suboptimal rules to govern the hemp industry. I then explain why a decision-making structure that uses collective intelligence would produce the most optimal rules to help the hemp industry achieve its highest potential while also producing rules that generate the most trust, consensus, and transparency among the people that the rules govern.

**Topic Areas**
Big Data
**Submission Format**
Oral

# Investigating Alcohol and Cannabis Co-use in a Survey Sample of Regular Cannabis Users and a Clinical Sample of Heavy Drinkers Enrolled in Alcohol Treatment

**Authors**
Dr. Hollis Karoly - University of Colorado Boulder
Ms. Chrysta Andrade - University of Colorado Boulder
Ms. Alexandra Zabelski - University of Colorado Boulder
Dr. Cinnamon Bidwell - University of Colorado Boulder
Dr. Kent Hutchison - University of Colorado Boulder

**Abstract**
Cannabis is commonly used among people who drink alcohol, but findings are mixed regarding the direction of this relationship. Motives for use, type of cannabis (e.g., high-CBD vs. high-THC, edible vs. smoked), frequency and amount used may all play a role in determining whether cannabis is associated with increased or decreased alcohol consumption. CBD has shown preclinical promise in decreasing alcohol consumption and medical cannabis users in particular report using cannabis to decrease alcohol consumption. Evidence also suggests a nuanced relationship between alcohol and cannabis among individuals engaged in alcohol treatment, depending upon cannabis use severity. This study includes survey data from regular cannabis users who also drink alcohol (N=564) and from treatment-seeking heavy drinkers enrolled in an 8-week alcohol intervention study who also use cannabis (N=48). On the survey, medical users (n=484) consumed fewer drinks per occasion than recreational users (n=75), $t(557)=-2.2$, $p=.038$. Flower cannabis users who reported using mostly CBD products (n=33) co-use alcohol and cannabis less often than individuals who use mostly THC (n=177) or THC+CBD (n=271) products $F(2,478)=11.59$, $p<.001$. CBD users also report fewer drinks per drinking day (DPDD) $F(2, 490)=4.205$, $p=.015$). Edible cannabis users (CBD n=42, THC+CBD n=270, THC n=96) users show the same pattern for DPDD $F(2,405)=4.332$, $p=.014$). In the intervention study, participants were classified as heavy (n=23) or light-to-moderate (n=25) cannabis users. These groups showed no differences in alcohol use pre-treatment. Among heavy cannabis users, change in DPDD from pre- to post- treatment was positively correlated with change in cannabis use ($r=.454$ $p=.029$), but light-to-moderate cannabis users showed no such relationship. Results suggest that medical users and users of high CBD products have less severe drinking patterns compared to recreational and higher THC users. In addition, heavy cannabis users who are engaged in alcohol treatment show decreased drinking associated with decreased cannabis use.

**Topic Areas**
Cannabis Harm Reduction
**Submission Format**
Oral

## The Road Ahead: CDOT & Partners Present Latest Marijuana-Impaired Driving Data, Trends, Research and Education Efforts

**Authors**
Dr. Denise A Valenti - IMMAD, LLC
Ms. Allison Rosenthal - CDOT
Mr. Glenn Davis - Highway Safety Manager, Colorado Highway Safety Office
Ms. Shannon Fender - Native Roots Dispensary
Mr. Sam Aspnes - Colorado Department of Transportation

**Abstract**
The Colorado Department of Transportation, state data analysts, law enforcement and marijuana industry representatives will present the latest marijuana-impaired driving traffic safety data and trends. The hosts will also lead a panel discussion on research gaps, the challenges in research and data gathering, and CDOT's response to the issue at large. Is driving high dangerous? Is the problem getting better or worse? How can we better understand and address the issue of marijuana-impaired driving?

**Topic Areas**
Cannabis Harm Reduction
**Submission Format**
Panel

# Spanish Language Cannabis and Health Survey: Improving Diversity and Representation in Community-Based Cannabis Research

**Authors**
Ms. Renee Martin-Willett - University of Colorado Boulder
Ms. Elizabeth Zambrano Garza - University of British Columbia
Dr. Cinnamon Bidwell - University of Colorado Boulder

**Abstract**
The field of cannabis and health research among humans remains to be largely conducted with young, white male research participants, and much of the work done in cannabis and health in the U.S. has largely ignored non-white communities or communities for whom English is not a primary or native language. For example, the extent literature concerning cannabis and self-identified Hispanic cohorts has particular gaps with regard to our knowledge of patterns, beliefs, and opinions surrounding the use of cannabis in primarily Spanish-speaking communities. Some studies have analyzed broad substance usage patterns according to ethnic group in national samples whereas other surveys have taken more focused approaches, for example either regionally or by acculturation status. Even fewer studies specifically investigated knowledge of or attitudes towards cannabis and were either framed in terms of cultural orientation or cultural values or were qualitative studies and/or included small samples sizes. Importantly, none of this previous work specifically examined medically motivated use.
Thus, this study describes the development of an online Spanish-language cannabis and health survey designed to seek data among Spanish speaking respondents in the context of these important topics, with particular attention to medically motivated and recreational use, mode of administration, and potency of products. This study also describes the unique challenges of conducting research on cannabis and health in Spanish speaking communities in the U.S. and the community engaged research strategies being used to encourage participation in the anonymous survey, such as face-to-face recruitment in collaboration with community-based organizations. Data collection is currently in the preliminary states and is ongoing with an expected sample of 45 by April, 2020.

**Topic Areas**
Cannabis Harm Reduction
**Submission Format**
Oral

## 10. Public Policy and Regulation

### Ex Post Evaluation: A New Paradigm in Drug Control Policy

**Authors**
Dr. Stephen Ziegler - Center for Effective Regulatory Policy & Safe Access

**Abstract**
The topic of drug control policy continues to generate a variety of ideas ranging from prohibition on one end, complete legalization at the other, and government regulation as falling somewhere in between. While there are good public health reasons to support the regulation of legal drugs, whether in the form of antibiotics, prescription opioids, or medical cannabis, the Organization for Economic Co-operation and Development (OECD) recognizes that "most countries do not know whether the regulations in place are actually needed and useful." Consequently, instead of eliminating regulation, perhaps the focus should be on its improvement so that regulatory policies are more effective in ensuring access to legal drugs, preventing abuse and intrusion of the gray and black markets. Accordingly, the following presentation will examine *ex post* evaluation as a new paradigm in drug control policy.

**Topic Areas**
Creating, Evaluating, and Improving Regulatory Policies
**Submission Format**
Oral

## Colorado Hemp Advancement and Management Plan (CHAMP) & Identifying and Overcoming Potential Challenges Along the Hemp Supply Chain.

**Authors**
Ms. Rebecca Laurie - Colorado Department of Regulatory Agencies
Dr. Max Nathanson - CDA
Dr. Kenneth Boldt - CDA
Dr. Daniel Glenn - CDA
Dr. Brian Koontz - CDA
Mr. Jeff Lawrence - CDPHE, Director
Dr. Peg Brown - CDA

**Abstract**
**TBD:**
**Panelists include leaders from state and tribal agencies and hemp industry experts.**

- Brian Koontz, CDA Hemp Program
- Jeff Lawrence, CDPHE, Director
- Peg Brown, Deputy Commissioner of Insurance, DORA
- Ken Boldt, State Bank Commissioner, DORA
- Ean Seeb, Governor's Office
- Thuy Vu, Hammer Enterprises
- Tribal Representatives - Confirmed but names TBD; Southern Ute, Ute Mountain Ute
- Backup: Hollis Glenn, CDA; Wondirad Gebru, CDA

**Topic Areas**
Creating, Evaluating, and Improving Regulatory Policies , Public Health Implications of Cannabis Policies- Colorado's Lessons Learned, US Cannabis Policy
**Submission Format**
Panel

## The Need for a Center of Excellence

**Authors**
Ms. Rebecca Laurie - Colorado Department of Regulatory Agencies
Dr. Wondirad Gebru - CDA
Dr. Rebecca Hill - CDA
Dr. Dawn Thilmany - CDA
Dr. Thuy Vu - CDA
Dr. Daniel Glenn - CDA

**Abstract**
TBD:
**Panel to include experts involved in CHAMP from CDA and CSU.**

- Wondirad Gebru, CDA, Hemp Program
- Dr. Rebecca Hill, CSU Fort Collins
- Ean Seeb, Governor's Office
- Thuy Vu, Hammer Enterprises
- Back up: Hollis Glenn, CDA; Brian Koontz, CDA

**Topic Areas**
Creating, Evaluating, and Improving Regulatory Policies , Public Health Implications of Cannabis Policies- Colorado's Lessons Learned, US Cannabis Policy
**Submission Format**
Panel
**Portable HPLC for 'Point of Need' Analysis of Cannabinoids in Hemp Flowers**
**Authors**
Mr. Sheldon Henderson - Axcend
Dr. Paul Peaden - Axcend

**Topic Areas**
Scientifically Driven Solutions to Maximize Plant Yield and Quality, Cannabis Natural Products Chemistry: Analytics & Preparative Methods
**Submission Format**
Oral

**Finding a Path Forward: The Legal and Regulatory Status of CBD**

**Authors**
Mrs. Stacey Worthy - Aimed Alliance

**Abstract**
Cannabidiol (CBD) products are seemingly everywhere these days, sold in everything from oils and tinctures to beauty products, bottled water, coffee, beer, and even pet treats. The passage of the federal Agriculture Improvement Act of 2018, commonly referred to as the Farm Bill, created the widespread perception that all CBD products are legal. Yet, the legality of such products is not so straightforward. For example, the FDA has stated that there currently is no regulatory pathway for approving food and dietary supplement products that contain CBD and has taken disciplinary action against nonpharmaceutical CBD manufacturers that make therapeutic claims about their products.
Given that these products have not gone through FDA's rigorous safety and efficacy process, consumers could be at risk of ingesting contaminated and unsafe substances. Laboratory testing has revealed that some CBD products on the market contain pesticides, heavy metals, marijuana, and inaccurate labels that misstate the actual amounts of CBD that are found in the product. As a result, there are reports of individuals losing their jobs due to unanticipated positive drug tests, leading to lawsuits, and children going to school intoxicated, leading to custody issues.
While the FDA weighs how to proceed with regulating CBD, states have also begun taking action, including by passing laws and engaging in enforcement efforts. Therefore, individuals who are passionate about advancing the CBD industry will find great value in this session's legal, legislative, and regulatory overview. Topics will include:
• Current state and federal laws that regulate CBD products;
• Recent lawsuits involving CBD;
• Conflicts between state and federal law that can be confusing to consumers;
• Details on the FDA's current thinking towards CBD products;
• The Food, Drug & Cosmetic Act;
• Marketing best practices; and
• Possible paths forward for the regulation of CBD products.

**Topic Areas**
US Cannabis Policy
**Submission Format**
Oral

## 11. Quality Assurance and Quality Control of Cannabis Products

### Systematic Variety Naming in Cannabis: Necessity and Approaches

**Authors**
Dr. John Brunstein - Segra International
Ms. May Cui - Segra International
Ms. Jerian Reynolds - Segra International

**Abstract**
Generally accepted varietal designations are the norm for most cultivated plants. When a varietal name is backed up by breeding and cultivation records, it can be reliably associated with particular characteristics. This is important to cultivators and end use customers. By contrast, if varietal names are meaningless, cultivation and final product characteristics become a game of chance. Cultivators, researchers, and end consumers of both recreational and medical cannabis and derived products deserve the same level of certainty that product names are accurately and reliably applied to single cultivars as vintners, breweries, and their customers enjoy. Selective breeding strategies for new and desirable varietals would be greatly accelerated if disparate breeders can reliably compare results from single cultivars accurately linked by name.
Drug type Cannabis cultivars are propagated and sold under well over 1000 unique names, from such well known appellations as “OG Kush” or “Sour Diesel” to the obscurity of “White Smurf” or “The Incredible Bulk”. Lacking strict regulation in the past, a combination of accidental and intentional causes may have contributed to irregularities in cannabis variety naming. Application of molecular fingerprinting technologies to extant cannabis samples from both grey and legal markets confirms this. Single names are found applied to wildly different genetic stocks; different names are applied to clonal materials from different sources; different lot numbers of ostensibly same material from same cultivator may be highly divergent; in some cases even single 1 g portions as sold have been detected to contain material from as many as four different genetic lineages.
Pros and cons of different DNA fingerprinting methods will be touched on, and their application as a core component of a larger framework to establish, legitimize, and standardize cannabis variety names to the benefit of the whole industry will be presented.

**Topic Areas**
Cannabis Standards – Need for Quality Control and Convention
**Submission Format**
Oral

## 12. Research administration and collaboration

### Marijuana Research at the National Institute on Drug Abuse

**Authors**
Dr. Heather Kimmel - National Institute on Drug Abuse, NIH

**Abstract**
While marijuana 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 marijuana use has become more permissive, while proliferating marijuana dispensaries for medical or recreational use are providing novel methods and formulations for consuming marijuana. We have been learning about some short-term effects of these policy changes; however, many questions remain unanswered about their longer-term public health impacts as well as other 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 marijuana 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 marijuana 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 marijuana-derived compounds for pain and addiction. This presentation will provide an update on the findings from marijuana policy research currently underway at NIDA described at previous ICR meetings, as well as information on available marijuana research opportunities in the context of overall NIDA priorities.

**Topic Areas**
Building Collaborations, Funding Opportunities, Research Administration
**Submission Format**
Oral

**Chuncheon Bioindustry Foundation and Cannabis**

**Authors**
Dr. Meehwa Shin - Chuncheon Bioindustry Foundation

**Abstract**
Chuncheon Bioindustry Foundation(CBF) is a non-profit organization established in 2003 by Chuncheon City and the mission is supporting bio companies in Chuncheon City including Gangwon Province.
CBF's another important role is providing of bio-economic strategy to local government.
Recently, CBF is preparing with Chuncheon City to start a project on cannabis.
Through this project, we are planning to extract, isolate and purify cannabidiol (CBD), which has been found to be effective in various diseases, by cultivating cannabis in large quantities, and also we will study the application of CBD to various bioactive research.
The project team established a consortium with farms, universities, bio companies and hospitals to deal with cannabis breeding to product development.
We also plans to use cannabis by-products such as feed additives, antibacterial, textile, environmental and for building resources.
Korea has strict regulations on hemp cultivation and research. Efforts to alleviate these regulations are needed to proceed with this project. CBF intends to make a lot of efforts to deregulate and suggest to the Korean Government the international trend of hemp industry.
CBF participates ICR conference to find a variety of partners who can collaborate and to learn more about the research and industry in the US about Cannabis and apply it to our projects.

**Topic Areas**
Phytochemicals: Cannabinoids and Terpenes, Cannabis Natural Products Chemistry: Analytics & Preparative Methods

**Submission Format**
Oral

# Seed-to-insight™ Cannabis Solution Provides Overlooked Chain of Custody Piece in Hemp Cultivation

**Authors**
Mrs. Terri Miller - SignaKey, LLC

**Abstract**
The U.S. Domestic Hemp Production Program got a big boost with the issuance of the Interim Final Rule (IFR) on October 31, 2019. Hemp production went from the R & D status afforded it by the 2014 Farm Bill, to that of a legitimate industry. To maintain this status, cultivators now face a series of regulatory challenges that can threaten seizure of whole crops, fines or even legal action.
Involvement of the USDA and DEA moves Hemp farming into a more rigid, formal process with certified labs, 3rd party sampling agents, and ticking clocks from sample to test dates. With these new parties and restrictions in place, there must be a chain-of-custody from the field to the Lab with all parties held accountable.
In the Fall of 2019, working with Act Labs, SignaKey devised a sampling method tested over several weeks on 40 Illinois hemp farms. This process involved lab technicians in the field placing samples in individual plastic bags- where they stood and securing the bag with an encrypted tamper-evident seal. As soon as the bag is sealed, the Signakey 2-D mark is scanned with a smartphone app. Scanning captures the GPS coordinates, time, date and user ID. The technician then moves to the next location to repeat the process. Once sampling for the entire field is complete, the samples go to the Lab. The Lab Manager first confirms that the seals are unbroken and then decodes the SignaKey. This establishes a secure chain-of-custody. Test results from this method of sampling may be used to identify 'hot zones' in the field and provide accountability for 3rd party agents.

**Topic Areas**
Regulatory Management
**Submission Format**
Oral