Welcome to Pueblo, Colorado!

I would like to personally welcome each of you to the Institute of Cannabis Research (ICR) 2018 Conference – *Exploring All Things Cannabis: Research in Action*. This is an exciting time for the ICR as we explore new frontiers in cross disciplinary research of the uses and impacts of cannabis in society. As a regional, comprehensive university, Colorado State University-Pueblo (CSU-Pueblo) is committed to supporting and enhancing our region by providing high-impact learning opportunities as well as research that increases knowledge and solves problems.

The ICR was created in 2016 through an innovative partnership between CSU-Pueblo and the State of Colorado. The ICR is not an advocacy arm, nor a business incubator for the cannabis industry. Instead, our mission is "to generate new knowledge of cannabis and its derivatives through research and education that improves lives and contributes to science, medicine and society." We are honored to be the first such University in the country to produce a multi-disciplinary academic journal of cannabis research and an annual conference that allows individuals from throughout the world to share their research results.

The success of this conference is dependent on the many people who have coordinated and organized the event. I would like to recognize the ICR Steering Committee, working groups, and CSU-Pueblo faculty, administrators, staff, and students for their efforts in planning and promoting the 2018 Conference.

I also would like to thank each of you for your attendance and participation at the ICR 2018 Conference. Your knowledge and research skills will help us pave the way for advancements in this burgeoning field.

If this is your first time on campus, we welcome you. If you are a returning conference attendee or frequent visitor to CSU-Pueblo, thank you always for your interest and support of the University.

Timothy Mottet
President, Colorado State University-Pueblo

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ICR Steering Committee

» *Rick Kreminski,* Chair, Institute of Cannabis Research
» *William Folkestad*, Dean, College of Humanities and Social Sciences
» *Brad Gilbreath*, Hasan School of Business
» *Rhonda Gonzales*, Dean, Library Services
» *Sandy Hudock*, Library Services
» *Nebojsa Jaksic,* College of Engineering, Education, and Professional Studies
» *Sylvester Kalevela*, Dean, College of Engineering, Education and Professional Studies
» *Dave Lehmpuhl*, Dean, College of Science and Math
» *Timothy McGettigan,* College of Humanities and Social Sciences
» *Bruce Raymond*, Interim Provost
» *Abhay Shah*, Interim Dean, Hasan School of Business
» *Sue Sisley*, External partner
» *Jeff Smith*, College of Science and Math

ICR Conference Committee

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» *Elizabeth Christian*, Library Services
» *Melody Dowell*, Institute of Cannabis Research
» *Justin Goss*, Hasan School of Business
» *Nebojsa Jaksic,* College of Engineering, Education, and Professional Studies
» *Bethany Kies*, College of Engineering, Education, and Professional Studies
» *Kathryn Starkey*, Extended Studies

ICR Staff

» *Rick Kreminski*, Director
» *Melody Dowell*, Grants Coordinator/ Programs Director
» *Sang Hyuck Park*, Senior Scientist/ Research Liaison

Cover Art

» *Jonothan Stephenson*, Extended Studies

Conference At A Glance

Thursday, April 26

Events on this day are free and open to the public.

2:00 PM	Registration opens	OSC Atrium
4:00–6:00 PM	Open forums	
6:30–8:00 PM	**Opening Plenary and Reception** *Dr. Audra Stinchcomb*, University of Maryland School of Pharmacy	OSC Ballroom

Friday, April 27

Refer to Friday Academic Program listing starting on page 6 for session room assignments.

7:30–8:30 AM	Coffee & Conversation	OSC Ballroom
8:45–9:45 AM	Official Welcome to ICR 2018 Conference	OSC Ballroom
10:00–11:15 AM	Session 1	
11:30–12:30 PM	Lunch Break	OSC Ballroom
12:30–1:45 PM	Session 2	
2:00–3:15 PM	Session 3	
3:30–4:45 PM	Session 4	
5:00–6:30 PM	Networking Reception	OSC Ballroom

Saturday, April 28

Refer to Saturday Academic Program listing starting on page 9 for session room assignments.

7:30–8:30 AM	Coffee & Conversation	Pack Cafe
8:30–9:45 AM	Session 5	
10:00–11:45 AM	Session 6	
11:30–1:30 PM	**Second Annual Mechoulam Lecture and Lunch** *Dr. Vicenzo Di Marzo*, Canada Excellence Research Chair on the Microbiome-Endocannabinoidome Axis in Metabolic Health at Université Laval, Quebec City, Canada, and Research Director and Coordinator of the Endocannabinoid Research Group, Institute of Biomolecular Chemistry, Consiglio Nazionale delle Ricerche, Pozzuoli, Napoli, Italy	OSC Ballroom
1:30–2:45 PM	Session 7	
3:00–4:15 PM	Session 8	
6:00–8:30 PM	ICR Research Poster Session and Closing Reception	El Pueblo History Museum 301 N Union Ave, Pueblo CO 81003 *Shuttle transportation provided*

General Information

Registration and Information Desk
Registration is located in the Occhiato Student Center (OSC) atrium, and will be open for the duration of the conference. Registration badges must be worn for admittance to all sessions, meals, and special functions. Lost badges can be replaced at the registration desk.

Complimentary WiFi
Password protected campus-wide wireless connectivity for all attendees is available.

» SSID: conference
» Password: CSUP_C0nf!

Conference App
The free conference app contains up-to-date conference program, abstracts, and scheduling tools.

» Download the CrowdCompass app from the app store
» Search for: Institute of Cannabis Research Conference 2018
» Create an account to build your personalized schedule

Hotel Information
ICR attendees are encouraged to use the conference's official hotel blocks for a discounted rate and easy access to the conference shuttle service. Be sure to mention the Institute of Cannabis Research when making reservations.

» Wingate by Wyndham ($93/night)
4711 N. Elizabeth Street
(719) 586-9000

» LaQuinta Inn and Suites ($80.10/night)
4801 N. Elizabeth Street
(719)542-3500

Shuttles
The ICR will run continuous shuttle service from CSU-Pueblo to the Wingate and LaQuinta throughout the conference. The pick-up and drop-off station is directly outside the OSC entrance.

Parking
On-campus parking is free for the duration of the conference. The closest parking lots are N-2, N-3, and N-4.

Directions
» From Interstate 25, take Exit 101 East to Highway 47.
» Take Bonforte Blvd exit. Turn left at the stop light to cross the bridge.
» Turn right at the intersection onto Bartley Blvd, then left into parking lots N-2, N-3, and N-4.

Photography Notice
Photographs, videos, and audio recordings may be taken by event organizers or personnel. All recordings and all rights associated with them will belong solely and exclusively to CSU-Pueblo, which shall have the absolute right to duplicate, reproduce, alter, display, distribute, and/or publish them in any manner, for any purpose.

Conference Proceedings and Materials
Abstracts from the 2018 conference will be published in the annual *ICR Conference Proceedings*, available summer 2018. Conference participants are invited to deposit their working papers, posters, presentation slides, and other materials in the official ICR Conference Repository.

Continuing Education Credits
The Institute of Cannabis Research has partnered with the CSU-Pueblo Division of Extended Studies to offer Continuing Education Units (CEUs) for conference attendees this year. The cost per CEU is $80, and the transcript fee is waived for ICR 2018 attendees. Interested attendees may register at the resgistration desk.

Paw Print and Copy Center
The Paw Print and Copy Center is located in the lower level of the Occhiato Student Center. It is open 8 am–4:30 pm, Monday through Friday, and only accepts payment by cash or check.

Poster Presenters
Display boards and pins will be provided. The recommended poster size is 3' x 5'. Poster presenters should arrive 10 minutes early to set up.

Presentation Technology
All presentation rooms are equipped with Windows-based presentation software, overhead projectors, and internet access. Presenters are encouraged to bring copies of their presentation materials on a flash drive. Presentation rooms are staffed with knowledgeable Student Ambassadors, and full-time IT staff are on call throughout the conference to troubleshoot issues.

ICR 2019 Conference
The third annual ICR Conference will be held April 25–27, 2019. The Call for Papers will be issued in summer 2018.

CSU-Pueblo Alcohol and Other Drugs Policy
Pursuant to federal law, possession, use, or sale of marijuana is prohibited on campus. Marijuana possession, use or sale is also prohibited at University sponsored events, even if held off-campus.

Conflict of Interest Disclosures
The ICR supports research explorations in a wide variety of disciplines that relate to cannabis, and in particular we encourage respectful, data-informed discourse at ICR 2018. All presenters are expected to state verbally, and include within any visual presentation materials, a disclosure of any existing or potential conflicts of interest, including funding sources for their particular project or proposed study.

Promotional Materials
Distribution of promotional materials during presentations, in session spaces, or elsewhere on campus is not allowed. Individuals wishing to publicize upcoming conferences may do so at the ICR message board located in the atrium of the OSC.

Conference Locations
Sessions will be held in the Occhiato Student Center (OSC) and in the Hasan School of Business (HSB). Meals and accompanying keynotes will be located in the OSC Ballroom. Conference attendees must display their registration badge for entry.

Colorado State University-Pueblo Campus Map

Colorado State University Pueblo™
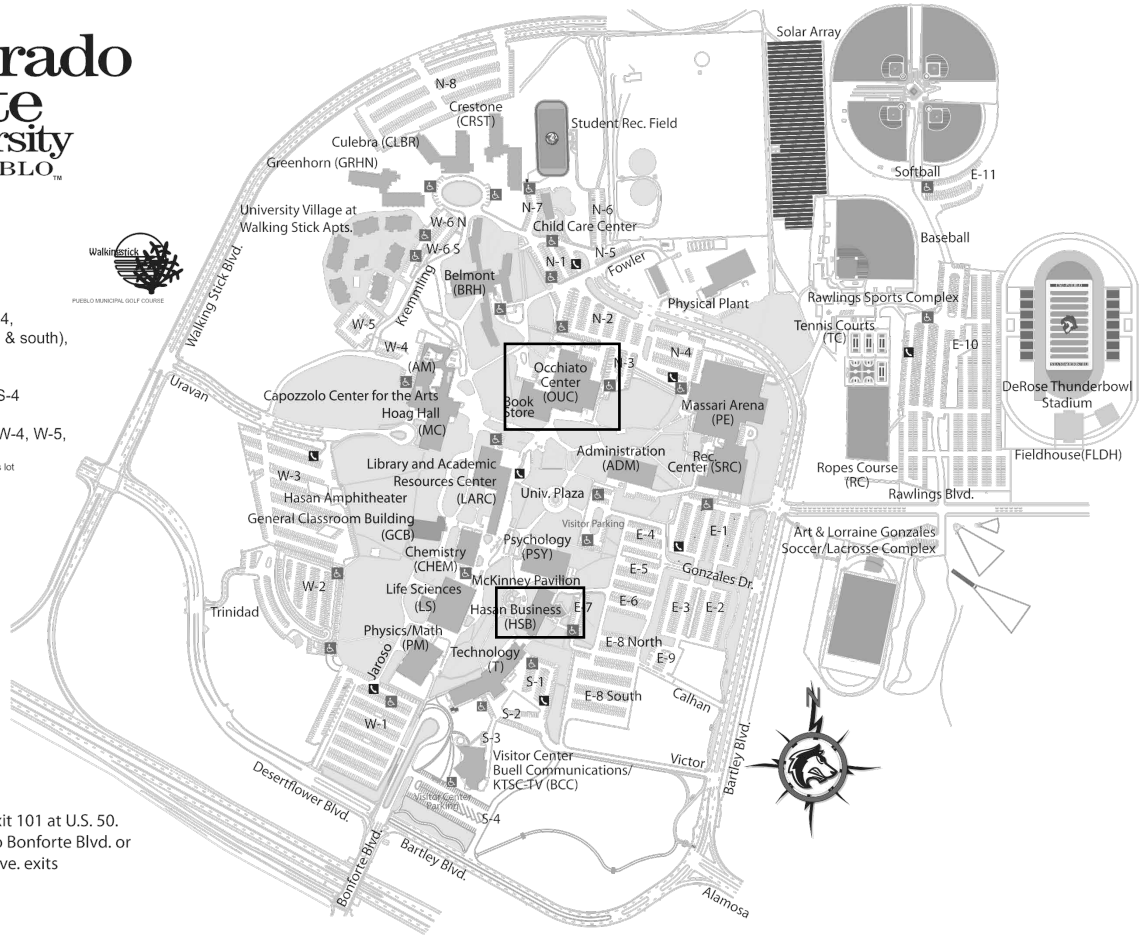
PARKING SECTORS

NORTH: N-1, N-2, N-3, N-4, N-5, N-6, N-7, N-8

EAST: E-1, E-2, E-3, E-4, E-5, E-6, E-7, E-8 (north & south), E-9, E-10, E-11

SOUTH: S-1, S-2, S-3, S-4

WEST: W-1, W-2, W-3, W-4, W-5, and W-6 (north & south)
*Visitors with permit may park in visitors lot or white lines only)
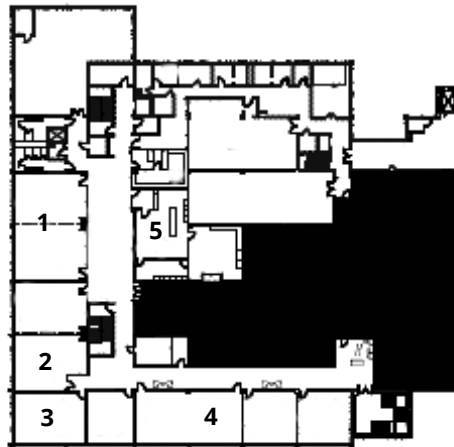
📞 Emergency Phones

♿ Handicapped

I-25 Exit 101 at U.S. 50.
East to Bonforte Blvd. or
Troy Ave. exits

Walkingstick

PUEBLO MUNICIPAL GOLF COURSE

Solar Array
N-8
Crestone (CRST)
Culebra (CLBR)
Greenhorn (GRHN)
University Village at Walking Stick Apts.
Student Rec. Field
Softball
E-11
Baseball
W-6 N
W-6 S
N-7
N-6
Child Care Center
N-5
N-1
Fowler
Belmont (BRH)
Physical Plant
Rawlings Sports Complex
W-5
N-2
Tennis Courts (TC)
E-10
W-4 (AM)
Occhiato Center (OUC)
N-3
N-4
DeRose Thunderbowl Stadium
Capozzolo Center for the Arts
Hoag Hall (MC)
Book Store
Massari Arena (PE)
Fieldhouse (FLDH)
Library and Academic Resources Center (LARC)
Administration (ADM)
Rec Center (SRC)
Ropes Course (RC)
W-3
Hasan Amphitheater
Univ. Plaza
Rawlings Blvd.
General Classroom Building (GCB)
Visitor Parking
Art & Lorraine Gonzales Soccer/Lacrosse Complex
Chemistry (CHEM)
Psychology (PSY)
E-4
E-1
W-2
McKinney Pavilion
E-5
Gonzales Dr.
Life Sciences (LS)
Hasan Business (HSB)
E-7
E-6
E-3
E-2
Trinidad
Physics/Math (PM)
E-8 North
E-9
Technology (T)
S-1
E-8 South
Calhan
W-1
S-2
Victor
S-3
Visitor Center Buell Communications/ KTSC-TV (BCC)
Visitor Center Parking
S-4
Desertflower Blvd.
Bonforte Blvd.
Bartley Blvd.
Alamosa

Walking Stick Blvd.
Kremmling
Uravan
Jaroso

2200 Bonforte Blvd.   ●   719-549-2100   ●   www.csupueblo.edu
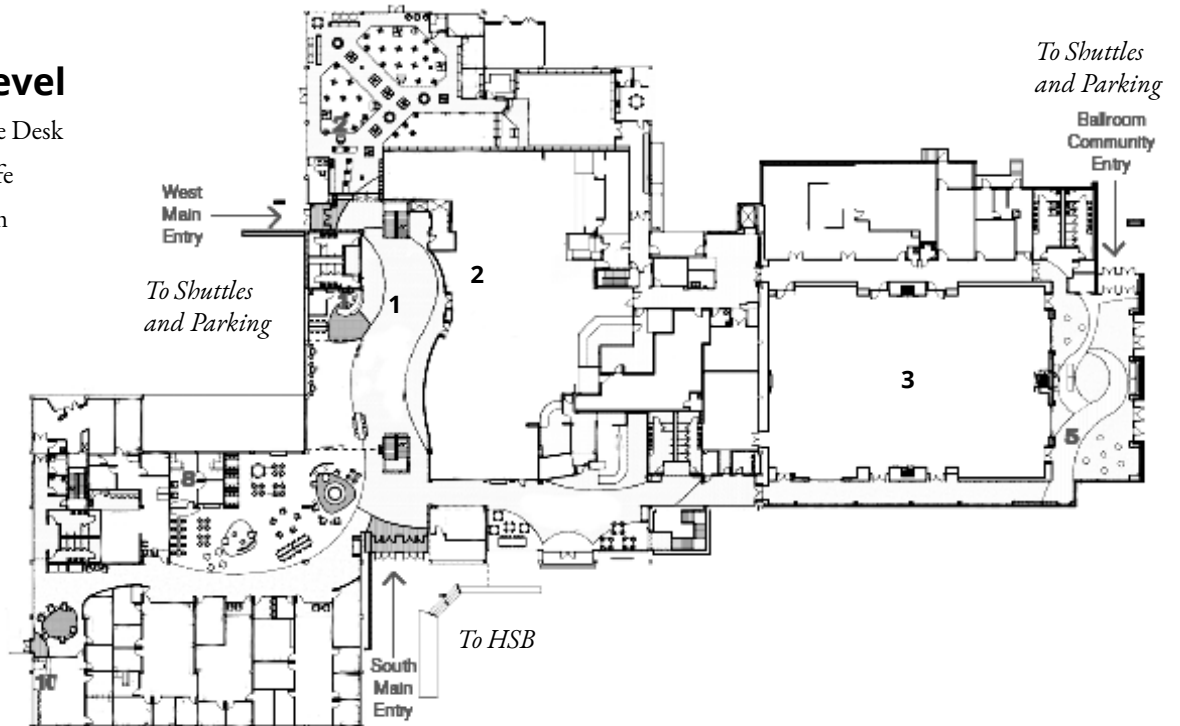
Occhiato Student Center

Lower Level

1. Tundra Meeting Room
2. Great Plains Meeting Room
3. Wolf Den Meeting Room
4. Aspen Leaf Meeting Room
5. Paw Print & Copy Center

Main Level

1. Welcome Desk
2. Pack Cafe
3. Ballroom

To Shuttles and Parking

To Shuttles and Parking

West Main Entry

Ballroom Community Entry

To HSB

South Main Entry

Upper Level

1. Serena Meeting Room
2. Monarch Meeting Room

Thursday Open Forums Program

Worker Protection Standard Train-the-Trainer Certification*
3:30–6:00 PM   Wolf Den

ORGANIZER: *Thia Walker*, Colorado State University, Pesticide Safety Education, Department of BSPM

The Colorado Environmental Pesticide Education Program (CEPEP) at Colorado State University is offering a workshop to certify persons as providers of worker and handler training under the 2015 Revised Worker Protection Standard.

Requires separate registration payment, please see the registration desk for more information.

Cannabis Engineering: A Look at the Present and 10 Years into the Future
4:00–5:00 PM   Tundra

ORGANIZER: *Nebojsa Jaksic*, Colorado State University-Pueblo

The More You Know Mini-Sessions: Informing Consumers and Citizens
4:30–6:00 PM   Great Plains

ORGANIZER: *Bethany Kies*, Colorado State University-Pueblo, and *Elizabeth Christian*, Colorado State University-Pueblo

Local experts discuss important issues for consumers and concerned citizens around legal cannabis use, revenues, and cultivation. Public resources from state agencies and Pueblo County are shared. Speakers include representatives from the Institute of Cannabis Research, Strawberry Fields Dispensary, and Grow Generation Hydroponics.

Cannabis, Homelessness, and Prosperity
5:00–6:00 PM   Aspen Leaf

ORGANIZER: *Tim McGettigan*, Colorado State University-Pueblo

Opening Plenary

Cannabis-Based Drug Delivery: University Lab to Medical Trials
6:30–8:00 PM   OSC Ballroom

Pueblo native Audra Stinchcomb describes twenty years of cannabis-based drug delivery research in less than an hour. The highs and lows of a start-up pharmaceutical company journey are illustrated. This talk takes you from CSU-Pueblo to Upstate New York to Kentucky, and back to CSU-Pueblo for the beginning of a fantastic three-day eclectic exploration of all things cannabis. Followed by a reception.

Friday Academic Program

1A: Panel
Acute Health Effects of Cannabis
10:00–11:15 AM   Tundra

ORGANIZER: *Janetta Iwanicki*, Rocky Mountain Poison and Drug Center

1B: Paper Session
10:00–11:15 AM   Great Plains

10:00 **Multiple Sclerosis, Cannabis, and Clinical Disability: A Molecular Imaging Study with 18F-FDG Positron Emission Tomography**
Thorsten Rudroff, Colorado State University

10:25 **Cardiac Effects of Cannabis in Post-MI Subjects**
Lori Walker, University of Colorado

10:50 **Reversing Neurological Disorders: A Metabolic Approach for Alzheimer's and Multiple Sclerosis**
Robert Melamede, Phoenix Tears Foundation, and *Danica Petrovic*

1C: Paper Session
10:00–11:15 AM   Aspen Leaf

MODERATOR: *Sanghyuck Park*, Colorado State University-Pueblo

10:00 **Associating Physical Traits to the Genome in *Cannabis Sativa***
Daniela Vergara, University of Colorado Boulder

10:25 **CO_2 Supercritical Extraction: The Next Frontier**
James Parco, University of Cannabis Technology, Colorado College, Purplebee's

10:50 **Cannabidiol (CBD) Increases Survival Rate of Ethanol-Treated Tobacco Hornworms (*Manduca Sexta*) by Alleviating Ethanol-Toxicity**
Sanghyuck Park, Colorado State University-Pueblo

1D: Panel
Safe Harbor: Legal Banking for Legal Cannabis
10:00–11:15 AM   HSB 101

ORGANIZER: *Sundie Seefried*, Partner, Colorado Credit Union

1E: Student Panel
Societal Perceptions of Community Impacts Since Legalized Recreational Marijuana
10:00–11:15 AM   HSB 110

ORGANIZER: *Kimberly Cowden*, Colorado State University-Pueblo

1F: Panel
Project 4-22
10:00–11:15 AM   HSB 111

ORGANIZER: *Blake Bell*, Project 4-22

1G: Paper Session
10:00–11:15 AM   HSB 113

10:00 **The Role of Openness to Experience in the Link Between Cannabis and Creativity**
Emily Lafrance, Washington State University

10:25   **Results of the Cannabis Users Survey on Health 2016**
Elyse Contreras, Colorado Department of Public Health and Environment, Marijuana Health Monitoring and Research Program

1H: Panel
Fast Track Creation of FDA Compliant Cannabis Translational Medical Products: Ideation through R/D to Clinical Results—Tracked to Qualitative/ Quantitative Cannabinoid Content
10:00–11:15 AM   Wolf Den

ORGANIZERS: *Stephen Goldner*, Pure Green, *John Althaus*, and *Debra Kimless*

2A: Student Panel
Cannabis as a Therapeutic Option for Chronic Pain Management, Curtailing the Opioid Addiction and Overdose Crisis: A Patient and Medical Perspective
12:30–1:45 PM   Tundra

ORGANIZER: *Kyle Dijon Hill*, Fight Opioid Addiction and Overdose with Medical Cannabis Project

2B: Paper Session
12:30–1:45 PM   Great Plains

MODERATOR: *Heather Kimmel*, National Institute on Drug Abuse

12:30   **An Informatics Research Agenda for Cannabis**
Brian Keegan, University of Colorado Boulder

12:55   **Marijuana Research at the National Institute on Drug Abuse**
Heather Kimmel, National Institute on Drug Abuse

1:20   **Educating the Cannabis Chemists of Colorado: Cannabis Chemistry at CU-Denver**
Vanessa Fishback, University of Colorado Denver

2C: Paper Session
12:30-1:45 PM   Aspen Leaf

12:30   **A Community-Driven Research Approach to Developing Cannabis Appellations of Origin**
Genine Coleman, Mendocino Appellations Project, *Rachel Giraudo*, California State University, Northridge

12:55   **Study of Industrial Hemp as Filler Material in ABS Filament Composites for 3D Printing FFF AM Process**
Nebojsa Jaksic, Colorado State University-Pueblo

2D: Panel
Running Numbers: An Analysis of the Three Primary Campaign Theories and Where Colorado Stands Five Years After Legalization
12:30–1:45 PM   HSB 101

ORGANIZER: *Andrew Livingston*, Vicente Sederberg LLC

2E: Panel
The Next Jim Crow: Reproducing Old Time Racism in New Cannabis Frontiers
12:30-1:45 PM   HSB 110

ORGANIZER: *Timothy McGettigan*, Colorado State University-Pueblo

2F: Panel
2017 to 2018: What's New with the "Legal" Status of Cannabis? A Review of Changes at the Federal Level
12:30-1:45 PM   HSB 111

ORGANIZER: *Linda Schutjer*, Colorado State University

2G: Paper Session
12:30–1:45 PM   HSB 113

12:30   **Unsafe Driving Behaviors After Using Marijuana and Other Substances among High School Seniors: Monitoring the Future, 2006–2016**
Steven Curry, BLH Technologies

12:55   **Chronic Cannabis Users Demonstrate Blunted Stress Reactivity**
Carrie Cuttler, Washington State University

1:20   **Impaired Driving and Cannabis: Media Reporting from Health Studies and Academic Research**
Lloyd Covens, West420 NewsWeekly

3A: Panel
Less is More: Exploring the Science of Microdosing
2:00–3:15 PM   Tundra

ORGANIZER: *Dorothy Colagiovanni*, Next Frontier Biosciences

PANELISTS: *Jordan Tishler*, InhaleMD, *Steve Cape*, *Cannabis patient*

3B: Paper Session
2:00–3:15 PM   Great Plains

2:00   **Cannabinoids and Terpenoids: A Balanced Look at an Expanded Perspective of the Entourage Effect**
James Parco, Colorado College, Mesa Organics, Purplebee's

3C: Paper Session
2:00–3:15 PM   Aspen Leaf

2:00   **Spatial Distribution of Cannabinoids, Terpenes, and Others Within Agricultural Cannabis Products**
Joseph Diverdi, XTR Systems, LLC/Colorado State University, and *Twinkle Paryani*

2:25   **Sensory and Chemical Analysis of Cannabis Aroma**
Joseph Diverdi, XTR Systems, LLC/Colorado State University, and *Avery Gilbert*

2:50   **A Technology Assessment of Leading Cannabis Tracking Systems**
Kevin Lang, The Global Element, LLC

3D: Student Panel
The Integration of Research, Development, and Analytics Along the Cannabis Supply Chain
2:00–3:15 PM   HSB 101

ORGANIZER: *Adam Rahman*, Acculliance

3E: Panel
The Cannabis Conversation—Let's Hash It Out: A Blunt Discussion About Cannabis Impaired Driving
2:00–3:15 PM   HSB 110

ORGANIZER: *Sam Cole*, Colorado Department of Transportation

3F: Panel
Interpretations of the Farm Bill: The Differences Between States and How That Impacts an Emerging Industry
2:00–3:15 PM   HSB 111

ORGANIZER: *Duane Sinning*, Colorado Department of Agriculture

3G: Paper Session
2:00–3:15 PM   HSB 113

MODERATOR: *Bill Thiebaut*, Colorado State University-Pueblo

2:00   The Relationship Between Cannabis and Homelessness
Donald Burnes, Burnes Center on Poverty and Homelessness

2:25   Policing the Black Body: Police Profiling of Blacks Looking for Marijuana (and Other) Illegal Drug Use
Earl Smith, George Mason University

2:50   An Analysis of News Coverage of the Cannabis Industry in Southern Colorado
Elizabeth Viall, Colorado State University-Pueblo, and *Joanne Gula*, Colorado State University-Pueblo

3H: Poster Session
2:00–3:15 PM   Monarch

1.   Subunit-Selective NMDA Receptor Modulation by a Non-Psychoactive Cannabinoid Analog Dexanabinol (HU-211)
Elijah Ullman, University of Montana

2.   Impact of Legal Cannabis on the Child Welfare System
Arlene Reilly-Sandoval, Colorado State University-Pueblo

3.   Alterations to Mitochondrial Metabolic Pathways During Cannabinoid Activation of CB1 Receptors Within Human Hepatocytes
Juan L. Rodriguez, Colorado State University-Pueblo

4.   CB2 Mediated Antiviral Activity in Hepatocytes
Joseph Lopez, Colorado State University-Pueblo

5.   Cannabidiol (CBD) Increases Survival Rate of Ethanol-Treated Tobacco Hornworms (*Manduca Sexta*) by Alleviating Ethanol-Toxicity
Kyle Staples, Colorado State University-Pueblo

6.   The Effects of 2-Arachidonoylglycerol, Anandamide, and 17Beta-Estradiol on Osteogenesis in Cultured Primary Human Osteoblasts
Derrick Williams, Colorado State University-Pueblo

7.   The Path from Plant to Products: Preparation of Nature Identical Cannabis Extracts
Jacqueline Harding, Cannabistry Labs

3I: Poster Session
2:00–3:15 PM   Serena

1.   Cannabis Use Patterns and Methods of Administration Among Virginia Adolescent Cigarette Smokers and Nonsmokers
Caroline Cobb, Virginia Commonwealth University

2.   Genotype-By-Environment Interactions of Economically Relevant Traits in Industrial Hemp (*Cannabis Sativa*)
Brian Campbell, Colorado State University

3.   Differential Effects on Cognitive Versus Reflexive Memory Recall After Cannabidiol Treatment
Amy Uhernik, Colorado State University-Pueblo

4.   Cannabidiol During Acquisition Mildly Affects Fear Learning and Memory in Mice
Zackary Montoya, Colorado State University-Pueblo

5.   A Randomized Trial of Medical Cannabis in Patients with Stage IV Cancers to Assess Impact on Opioid Use and Cancer-Related Symptoms: A Pilot and Feasibility Study
Dylan Zylla, Park Nicollet

6.   Comparative Chloroplast Genome Studies of *Cannabis Sativa* Strains
Cassandra Perlick, Colorado State University-Pueblo

7.   Impact of Medical Cannabis on Patient-Reported Symptoms for Cancer Patients Enrolled in Minnesota's Medical Cannabis Program
Susan Anderson, Minnesota Department of Health Office of Medical Cannabis

3J: Panel
The Environmental Consequences of Cannabis Policy
2:00–3:15 PM   Wolf Den

ORGANIZER: *Tony Silvaggio*, Humboldt Institute for Interdisciplinary Marijuana Research

4B: Paper Session
3:30–4:45 PM   Great Plains

3:30   Educating in the Gap: A Novel Approach to Harnessing the Subtle Energy of the Endocannabinoid System to Create Multidimensional Climates of Healing with Human Biocrystals in Population-Focused Public Health
Courtney Allen-Gentry, Center for Integrative Nursing and Cannabinoid Sciences

3:55   Cannabis: Spirit, Mind, Body: What Have We Learned?
Michael Scott, Project PC

4:20   The Spectrum and Prevalence of Reactions to Marijuana in a Colorado Allergy Practice
William S. Silvers, University of Colorado School of Medicine, *Tiana M. Bernard*

4C: Paper Session
3:30–4:45 PM   Aspen Leaf

MODERATOR: *Adin Alai*, 9Fiber, Inc

3:30   Using Microbial Biostimulants to Enhance Productivity? Promise, Possibilities and Challenges
Colin Bell, Growcentia, Inc

3:55   Spectral Control of Vegetative Growth in Cannabis
James Parco, Colorado College, and *Matt Wheatley*, University of Cannabis Technology

4:20   New Technology for the Cannabis Circular Economy: Recycling Waste Stalks and Stems into Fiber
Adin Alai, 9Fiber, Inc, and *David Bush*

4D: Panel
Worker Health and Safety in the Cannabis Industry
3:30–4:45 PM   HSB 101

ORGANIZER: *Roberta Smith*, Colorado Department of Public Health & Environment

4E: Panel
Cannabis and Schools: Student Use, Prevention, Intervention and School Revenue
3:30–4:45 PM   HSB 110

ORGANIZER: *Tim Peters*, Colorado State University Pueblo

PANELISTS: *Lynn Knight,* Colorado State University-Pueblo, *Margie Massey,* Colorado State University-Pueblo, *Jenny Piazza,* Colorado State University-Pueblo, *Pam Richmond,* and *Ron Wiley*

4F: Panel
Lifers Madness the Movie
3:30–4:45 PM   HSB 111

ORGANIZER: *Jeffrey Eichen*, Rawmaste Productions & Goods

4G: Paper Session
3:30–4:45 PM   HSB 113

3:30   **Utilization of Medical Cannabis Among Persons Living with Chronic Conditions in Illinois: Self-Reported Symptomology, Preferred Ingestion Methods, and Frequency of Use**
Douglas Bruce, DePaul University, Department of Health Sciences

3:55   **Including PTSD in Colorado: The Intersection Between Research, Politics and Public Opinion in Medicinal Cannabis Policy**
Teri Robnett, Cannabis Patients Alliance

4:20   **The Jack Splitt Memorial Marijuana Resource Bank**
Omar Estrada, Colorado Department of Education

4H: Panel
Cannabis, Pregnancy, Breastfeeding, and Motherhood
3:30–4:45 PM   Wolf Den

ORGANIZER: *Jeanna Hoch*, CannaMama Clinic

Saturday Academic Program

5B: Paper Session
8:30–9:45 AM   Great Plains

MODERATOR: *Rebecca Craft*, Washington State University

8:30   **Δ-Tetrahydrocannabinol and Cannabidiol Treatment of Inflammatory Pain in Rats**
Rebecca Craft, Washington State University

8:55   **Opioids and Marijuana in the Management of Pain: Is There a Relationship?**
Kenneth Finn, Springs Rehabilitation, PC

9:20   **Perceived Acute Effects of Cannabis on Negative Affect**
Carrie Cuttler, Washington State University

5C: Paper Session
8:30–9:45 AM   Aspen Leaf

8:30   **Dosing and Microdosing Medical Cannabis: Why, Who and How**
Jordan Tishler, InhaleMD

8:55   **"I Ate How Much?!" User Experiences with Cannabis Edibles**
Josh Meisel, Humboldt State University, *Sue Sisley*, Scottsdale Research Institute, and *Jane Fraser*, Colorado State University-Pueblo

9:20   **Budtender Horror Stories**
Evan Hundhausen, Author, Freelance Writer, Freelance Journalist

5E: Panel
The Highs and Lows of Collegiate Cannabis Prevention Efforts: Lessons Learned from an Adult Use State
8:30–9:45 AM   HSB 110

ORGANIZERS: *Laurie Jevons*, NASPA, and *Mallory Jordan*

5G: Paper Session
8:30–9:45 AM   HSB 113

8:30   **Relationships Among Cultivars, Leisure Interests and Leisure Motivations in a Sample of Young Adult Cannabis Consumers**
James Gould, University of Northern Colorado, and *Richard Donnelly*

8:55   **Cannabis Use Patterns and Healthcare Encounters in Colorado**
Daniel Vigil, Colorado Department of Public Health & Environment

9:20   **Cannabis: Retina, Brain and Functional Impairment**
Denise A Valenti, IMMAD

5H: Poster Session
8:30–9:45 AM   Monarch

1.   **An Experimental Investigation of Cannabis Policy Environments on Cannabis Use Attitudes, Norms, Beliefs, and Intentions Among Young Adults**
Alyssa Rudy, Virginia Commonwealth University

2. Gender Differences in Patterns of Marijuana Use Over Time in the 55–64 Year Old Population
Kasia O'Connell, Westat, and *Jessica Taylor*

3. Evidence of a Link Between Obsessive-Compulsive Disorder and Cannabis Misuse
Dakota Mauzay, Washington State University

4. The Entourage Effect: Concerted Teamwork or Chemical Complexity?
Adam Richardson, Aegis Biotech

5. More Than Just Taste and Smell: Examining the Complexity and Diversity of Terpene Profiles from Popular Cannabis Strains
Andrew Defries, Sangre AgroTech

6. Oncology Clinicians and the Minnesota Medical Cannabis Program: A Survey on Medical Cannabis Practice Patterns, Barriers to Enrollment, and Educational Needs
Dylan Zylla, Park Nicollet

5I: Poster Session
8:30–9:45 AM   Serena

1. Genomics and Genetics in the Cannabaceae Family
Dong Zhang, Colorado State University

2. How Much THC Did You Smoke?
Cristina Sempio, University of Colorado Denver

3. Exploring Farmworkers' Safety and Health Issues Working in Cannabis Industry
Farzaneh Khorsandi, University of California, Davis, *Marc B. Schenker*, Western Center for Agricultural Health and Safety, and *Diane Mitchell*, Western Center for Agricultural Health and Safety

4. Novel Genotyping Methods Reveal Large Diversity in Terpenoid Catalytic Sites in *Cannabis Sativa*
Christian Cizek, Steep Hill

5. A Survey Study of the Health Impact of Cannabinoid Use among Patients with Autism Spectrum Disorders
John Matuszewski, Realm of Caring Foundation

6A: Panel
Smart Product Design Through Clinical Data Mining
10:00–11:15 AM   Tundra

ORGANIZER: *Raj Gupta*, Folium Biosciences

6B: Paper Session
10:00–11:15 AM   Great Plains

MODERATOR: *Heather Jackson*, Realm of Caring Foundation

10:00 Effects of Cannabinoids in Adults with Medically Refractory Epilepsy
Barbara Brett, Colorado State University-Pueblo

10:25 Open Label, Dose Escalation Study of Cannabidiol in Parkinson's Disease
Maureen Leehey, University of Colorado

10:50 A Prospective Natural History Study of Cannabinoid Use among Patients with Epilepsy
Heather Jackson, Realm of Caring Foundation

6C: Paper Session
10:00–11:15 AM   Aspen Leaf

MODERATOR: *Charles Cattermole*, Grand Canyon University

10:00 Cannabis Legalization in Colorado and the Impact on Travel and Tourism
Charles Cattermole, Grand Canyon University

10:25 Medical Marijuana Is Dead, Long Live Medical Marijuana: A Public Policy Analysis of Cannabis Markets in Transition
Jason Kikel, Cannabiz Media, and *Joe Sciabica*

10:50 Political Risk and Investment in the Cannabis Industry
Jared Bressler, Colorado State University-Pueblo

6E: Panel
The New Cannabis Paradigm: **A New Book About All Things Cannabis**
10:00–11:15 AM   HSB 110

ORGANIZERS: *Timothy McGettigan*, Colorado State University-Pueblo, and *Rachel Giraudo*, California State University-Northridge

6F: Panel
An Analytical Look at Hemp Genetics Using Traditional and Modern Methods
10:00–11:15 AM   HSB 111

ORGANIZER: *Elliot Brown*, Colorado State University-Pueblo

Mechoulam Lecture

The Phytocannabinoidome and the Endocannabinoidome: How Close Are They?
11:30–1:30 PM   OSC Ballroom

LECTURER: *Dr. Vicenzo Di Marzo*, Canada Excellence Research Chair on the Microbiome-Endocannabinoidome Axis in Metabolic Health at Université Laval, Quebec City, Canada, and Research Director and Coordinator of the Endocannabinoid Research Group, Institute of Biomolecular Chemistry, Consiglio Nazionale delle Ricerche, Pozzuoli, Napoli, Italy

Studies on the pharmacological mechanism of action of the major psychotropic principle of some varieties of *C. sativa*, i.e., $\Delta(9)$-tetrahydrocannabinol (THC), led to the discovery of the endocannabinoid (eCB) system. The eCB system is currently defined as the ensemble of the two 7-transmembrane-domain and G protein-coupled receptors for THC, but not for most other plant cannabinoids, or phytocannabinoids (pCBs)—i.e., cannabinoid receptor type-1 (CB1) and type-2 (CB2); their two most studied endogenous ligands, the eCBs, N-arachidonoylethanolamine (anandamide) and 2-arachidonoylglycerol (2-AG); and the proteins and enzymes responsible for eCB biosynthesis and inactivation. However, anandamide and 2-AG, like the pCBs, have more molecular targets than just CB1 and CB2. Furthermore, the eCBs, like most other lipid mediators, have more than just one set of biosynthetic and degrading pathways and enzymes, which they often share with "eCB-like" mediators that may or may not interact with the same proteins as THC and other pCBs. In some cases, these degrading pathways and enzymes lead to molecules that are not inactive and instead interact with other receptors. Finally, some of the metabolic enzymes may also participate in the chemical modification of molecules that have

very little to do with eCB and pCB targets. In my talk I will review the whole world of lipid ligands, receptors, and enzymes, a true "endocannabinoidome," discovered after the cloning of CB1 and CB2 and the identification of anandamide and 2-AG, its physiopathological function, and its interactions with the "phytocannabinoidome." The possible role of the endocannabinoidome in gut microbiome actions will also be touched upon.

7A: Panel
Cannabis Patient Registry
1:30–2:45 PM   Tundra

ORGANIZER: *Sue Sisley*, Scottsdale Research Institute

PANELISTS: *Jane Fraser*, Colorado State University-Pueblo, and *Patrick McCarthy*, ValidCare

7B: Paper Session
1:30–2:45 PM   Great Plains

1:30   **Cannabis: The Exit Drug**
          Uma Dhanabalan, Global Health & Hygiene Solutions, LLC - Uplifting Health & Wellness

1:55   **A Metabolic Perspective on the Evolution of Species and Cancer**
          Robert Melamede, Phoenix Tears Foundation

2:20   **Better Than Cannabis? Can Big Pharma and Medical Marijuana Co-Exist?**
          Martin A. Lee, Director, Project CBD

7C: Paper Session
1:30–2:45 PM   Aspen Leaf

1:30   **Job Quality in Colorado's Cannabis Industry**
          Brad Gilbreath, Colorado State University-Pueblo, *Patrick Radigan*, Colorado State University-Pueblo, and *Sara Yacovetta*, Three Rivers Dispensary

1:55   **Occupational Safety Training for Marijuana Cultivation Workers**
          Joshua Scott, Center for Health, Work and Environment at the Colorado School of Public Health

7F: Panel
Pharmacy to Philosophy to Poetry: What is Your Bliss Beyond Cannabis?
1:30–2:45 PM   HSB 111

ORGANIZER: *Dean Frankmore*, Colorado Center for Cinematic Studies

8A: Panel
Translating Science into Products That Perform
3:00–4:15 PM   Tundra

ORGANIZER: *Raj Gupta*, Folium Biosciences

8B: Paper Session
3:00–4:15 PM   Great Plains

MODERATOR: *J. Jordan Steel*, Colorado State University-Pueblo

3:00   **Analysis of the Metabolic Pathways Affected During Cannabinoid Receptor Activation and Its Impact on Viral Replication Using a Seahorse XF Analyzer**
          J. Jordan Steel, Colorado State University-Pueblo

3:25   **Compound-Specific Carbon Isotope Measurements of Lipids Verify Cultivation Conditions of Cannabis of Unknown Origin**
          Brett J. Tipple, University of Utah

8C: Paper Session
3:00–4:15 PM   Aspen Leaf

3:00   **A Study on THC Thermal Degradation**
          Mark Angerhofer, PhytaTech

3:25   **A Survey of Cannabis Plant Material in Colorado for the Presence of Mycotoxins**
          Kris Chupka, Next Frontier Biosciences

3:50   **Development of a Novel, Efficient Method for the Extraction of Cannabidiol (CBD) from Bulk Industrial Hemp**
          Dustin Seifried, Colorado State University-Pueblo

8E: Panel
A New Taxonomy for the Plant of Many Names
3:00–4:15 PM   HSB 110

ORGANIZER: *Louis Adam*, Cantelligence

8F: Panel
#Cannabisjournalism: Reporting on America's New Normal
3:00–4:15 PM   HSB 111

ORGANIZER: *Andrew Matranga*, University of Denver

Abstracts

1A: Acute Health Effects of Cannabis

Janetta Iwanicki, Rocky Mountain Poison and Drug Center

This panel addresses the acute health effects of cannabis. Speakers will address topics such as poison center data after statutory changes, pediatric presentations, emergency department visits, hyperemesis syndrome, and cannabis-associated fatalities.

1B: Multiple Sclerosis, Cannabis, and Clinical Disability: A Molecular Imaging Study with 18F-FDG Positron Emission Tomography

Thorsten Rudroff, Colorado State University

Investigations into resting brain function in healthy individuals, as measured by Positron Emission Tomography and the glucose analogue [18F]-Fluorodeoxyglucose (FDG) have shown, that healthy regular cannabis users have lower cerebellar glucose uptake at rest compared to non-users. Lower brain glucose uptake has been observed in people with multiple sclerosis (PwMS) compared to healthy controls and has been negatively associated with disease symptoms such as fatigue and impaired cognitive function. The primary aim of this study was to examine resting brain glucose uptake in people with multiple sclerosis currently using (n=8) and not using (n=8) cannabis. Our secondary aim was to determine if users and non-users performed differently on standard clinical assessments of disability and if these differences were associated with altered brain glucose uptake. All cannabis users tested positive $\Delta 9$-tetrahydrocannabinol via urinalysis prior to experiments. Participants underwent Positron Emission Tomography/Computed Tomography imaging 45 minutes after injection of 9 ug of FDG.

Image analysis revealed that regular cannabis users did not demonstrate lower brain glucose uptake. In fact, cannabis users demonstrated greater glucose uptake in small areas throughout the frontal and temporal lobes, e.g., inferior frontal gyrus, temporal pole, and frontal pole. Physical disability was not different between users and non-users, although cognitive function was worse in cannabis users. The difference in cognitive function was not associated with altered resting brain glucose uptake in any of the examined regions. Across all participants, greater glucose uptake in regional brain areas (cerebellum, frontal-, parietal-, occipital-, temporal-lobes, and brain stem) was associated with less disability; specifically: fatigue, disability status, and pain. Our findings indicate that regular cannabis use does not appear to negatively affect brain glucose uptake or physical function in PwMS. However, cannabis should be used under medical supervision with a focus on possible negative cognitive effects.

1B: Cardiac Effects of Cannabis in Post-MI Subjects

Lori Walker, University of Colorado

Background: Recent federal data reported a stunning 455% increase in marijuana consumption among US adults ages 55–64 years and 333% in ages >64 between 2002 and 2014. Furthermore, the incidence of cardiovascular disease, including coronary artery disease, increases dramatically with increasing age. Therefore, it is likely that people with cardiovascular disease will be regular cannabis users. While it is well accepted that cannabis use can increase heart rate, the effects on cardiac rate and rhythm in people with cardiovascular disease is poorly understood.

Objective: To determine the effects of cannabis consumption on cardiac rate and rhythm in healthy subjects with no pre-existing cardiac disease and in subjects with cardiac disease.

Methods: Healthy regular cannabis users (2 times/week or greater) and cannabis users with a history of myocardial infarction (MI) were fitted with ZioPatch cardiac monitors. Subjects recorded cannabis use, including strain and an estimate of dose. Using ambulatory cardiac monitoring for up to 14 days, we compared cardiac rate and rhythm profiles for one-hour prior to cannabis use to a four-hour period following cannabis use. Subjects with prior MI were age- and sex-matched to subjects with no pre-existing cardiac disease.

Results: This study is ongoing. To date, 17 control subjects and 7 post-MI subjects have been enrolled; 16 males and 8 females. In general, cannabis use was associated with non-significant short-term increases in heart rate in both groups. At 1-hr post consumption, heart rate in control subjects was 4.5% ± 10.6% higher than heart rate 1 hour prior to consumption and in the post-MI group, heart rate 1-hr post consumption was 1.2% ± 10.2% higher compared to 1 hour prior to consumption. In the post-MI group, there was an increased incidence of supraventricular tachycardia (SVT) with 40% of post-MI subjects experiencing SVT compared to 10% of the control subjects. Similarly, there was an increase in the incidence of non-sustained ventricular tachycardia in post-MI subjects (20% of post-MI subjects and none of control subjects).

Conclusions: Cannabis use is associated with non-significant increases in heart rate. In post-MI subjects, the incidence of cardiac arrhythmias was higher than in those without ischemic heart disease. However, further analysis is necessary to determine whether the increased incidence of cardiac arrhythmias is a function of cannabis use or a function of their structural heart disease. Additionally, it is important to note that these data are preliminary and further study is necessary to determine the safety of cannabis use in subjects with cardiac disease.

1B: Reversing Neurological Disorders: A Metabolic Approach for Alzheimer's and Multiple Sclerosis

Robert Melamede, Phoenix Tears Foundation, and *Danica Petrovic*

The medical marijuana community, composed of citizen scientists around the world, has made dramatic progress in treating human diseases. Neurologic disorders such as multiple sclerosis (MS) and Alzheimer's have devastating consequences for patients and their families. The use of cannabis preparations, in combination with appropriate nutritional inputs and guided by the metabolic prospective for understanding the physical basis of life, can significantly restore an individual's health.

How can issues of health be addressed in the absence of understanding the underlying mechanisms of life? There is accumulating evidence that living systems function as mathematical attractors. By providing proper systemic inputs, an individual can move towards a state of optimal health as measured by the system's distance from equilibrium. Consequently health outcomes that were previously thought impossible are now happening routinely with cannabis use.

It is proposed that cannabis exhibits amazing health promoting properties by controlling stem cell expansion. Stem cells stay young by burning fat for fuel as directed by the CB2 receptor. Subsequently, stem cell differentiation is promoted by efficient electron transport

driven ATP production as directed by the CB1 receptor. This conceptual framework explains the amazing results observed when treating MS and Alzheimer's patients.

Appropriately treated MS some patients with extreme disability are no longer wheelchair bound. A few patients now jog regularly! Here are some patient's comments: "my feet no longer cold and dead," "my color sight is restored," "I wiggled my toes for the first time in 11 years."

Even more surprising results are seen with an 80 year old retired Romanian physician who was institutionalized with final stages of Alzheimer's. He has gone from being completely incapacitated to increasing functionality with periods of being almost normal. He now understands he is sick and wants to get better. When in his good periods he even cracks jokes!

We will provide video documentation and medical histories.

1C: Associating Physical Traits to the Genome in *Cannabis Sativa*
Daniela Vergara, University of Colorado at Boulder

Genetic maps—the arrangement of genes and their particular positions into chromosomes—provide indispensable information about the location of and distances between genes, which then allows for informed breeding decisions that can be used to rapidly combine the desired traits of interest into a single strain. For the past 2-3 years we have been working on a cross of two *Cannabis* plants with very distinct characteristics. One of them is a tall hemp plant with little secondary metabolite production, which was crossed to a short medicinal-type marijuana plant. In addition to multiple phenotypic measurements collected for each of the offspring plants, we sequenced their genome and are currently analyzing this big dataset. The preliminary results I present are the analysis of the phenotypic traits and the location of the genes within the genome. Our plan is to associate these physical characteristics with chromosomal regions, to help identify how the major genetic differences between the parents lead to variation in secondary compound production, growth rate and architectural differences. This is called QTL mapping, and will tell us which chromosomal regions contain genes with substantial effects on each of the traits we measure, enabling more efficient breeding, using marker-assisted selection in future and ongoing crosses.

1C: CO_2 Supercritical Extraction: The Next Frontier
James Parco, University of Cannabis Technology, Colorado College, Purplebee's, and *Todd Knupp*, University of Cannabis Technology

As the cannabis industry continues to expand, new technologies are emerging to improve commercial production, public heath and safety and consumer welfare. Chief among new technologies is the use of carbon dioxide as an alternative to the more common hydrocarbon extraction method. Although CO_2 extraction accounts for less than 10% of the total cannabis extraction market, as more state legalize, there is an increased interest in promoting non-hydrocarbon-based methods. We provide an overview of this new technology to disseminate knowledge and meet market demands for increased education and training.

1C: Cannabidiol (CBD) Increases Survival Rate of Ethanol-Treated Tobacco Hornworms (*Manduca Sexta*) by Alleviating Ethanol-Toxicity
Sanghyuck Park, Colorado State University-Pueblo

Cannabis sativa, also known as marijuana, produces at least 120 cannabinoids. Cannabidiol (CBD) is the most prevalent non-psychoactive compound that is accumulated in the glandular trichomes of female flower. Cannabidiol has shown promise as a potential therapeutic agent on numerous human diseases. In this research, the author proposes a protective function of CBD against ethanol (EtOH) in tobacco hornworms (*Manduca sexta*). Our insect feeding assay indicates that the increase of EtOH toxicity is negatively correlated with insect development (larval growth) and behaviors (diet consumption and mobility). The artificial diet (AD) containing >1% EtOH appeared to be lethal. However, when 2mM CBD was administered, the survival rate increased by ~40% comparing to insects reared on 2% EtOH diet. In addition, the CBD-administered insects outperformed EtOH only-treated insects. The 1mM CBD-treated insects present ~78% size and ~710% weight increase than those of insects grown on 1% EtOH diet. Furthermore, 1mM CBD administration increases diet consumption (~500%, p<0.05) and mobility (~53%, p>0.05) comparing to 1% EtOH-fed control insects. The electrophysiology results also reveal that CBD treatments effect electric response (mV) of the ganglion central nerve system in a tobacco hornworm. The 1mM CBD-treated ganglia responded more rapidly with electric stimuli, the response was 2.37mV while the electric response of ganglia from hornworms reared on AD was 0.87mV, and AD+1%EtOH diet was 1.57mV. This may indicate the presence of CBD receptor in an invertebrate system. Our study presented here reveals the protective effects of CBD on the EtOH-intoxicated tobacco hornworms, leading to an increased survival rate.

1D: Safe Harbor: Legal Banking for Legal Cannabis
Sundie Seefried, Partner Colorado Credit Union

Sundie Seefried is CEO and president of Partner Colorado Credit Union, located in Denver, Colorado. She has served in the credit union industry since 1983 and as CEO since 2001. Poised to retire in 2014, Seefried instead embarked on what has been the biggest challenge of her eventful career: designing and building "Safe Harbor Private Banking," a full-scope cannabis banking program. The program she devised, tested and launched has not only withstood the scrutiny of federal and state regulators, it has succeeded financially. Just as important, by banking an industry that once had little choice but to execute all of its transactions in cash, Seefried and her Partner Colorado team have made communities all over Colorado safer.

1E: Societal Perceptions of Community Impacts Since Legalized Recreational Marijuana
Kimberly Cowden, Colorado State University-Pueblo

The purpose of this study was to understand how key stakeholders in Pueblo perceive impacts in the Pueblo community since legalization of recreational marijuana. Using a series of in-depth interviews with law enforcement, health care, social work and area educators (n=24), the research team discovered that key stakeholders appreciated the tax revenue generated from legalized recreational marijuana, yet also noted concern about increases in crime, increase in opioid abuse and an increase in homelessness. This panel will report the primary findings

from this study and offer communication theories to address the community members' concerns.

1F: Project 4-22
Blake Bell, Project 4-22

A follow up to Project 4-22's presentation at the inaugural conference. Covering current medical options for veterans, and the issues surrounding them. Delving into social, behavioral and ethical issues surrounding veterans using cannabis in lieu of other medications. Updates on current studies involving veterans and the medical implications of traditional vs marijuana treatments in the veteran community. 22 veterans from Missouri will accompany Blake Bell as well as the 22 veterans from the first year's trip for a total of 44 veterans. Possible panel of high ranking military veterans explaining the issues veterans face.

1G: The Role of Openness to Experience in the Link Between Cannabis and Creativity
Emily Lafrance, Washington State University

Popular culture has perpetuated the notion that cannabis use enhances creativity. However, the results of previous research on the subject remain somewhat equivocal. The vast majority of this research has examined the effects of acute cannabis intoxication on creativity, while only a small number of studies have examined differences between sober cannabis users' and non-users' creativity. Further, cannabis users and non-users are known to demonstrate differing patterns of personality traits, including openness to experience, which has been linked to heightened creativity. However, to date no research has explored the role of personality traits in the link between cannabis and creativity. Therefore, the present study was designed to examine differences in sober cannabis users' and non-users' self-reported and objective creativity, and to investigate whether any of the Big 5 personality domains underlie these differences. A sample of sober cannabis users (n=412) and non-users (n=309) completed measures of cannabis consumption, personality, self-reported, and objective creativity. Self-reported creativity was assessed using the Kaufman Domains of Creativity Scale (K-DOCS) and the Creative Behaviors Inventory (CBI); while objective creativity was assessed using the Alternate Uses Test of divergent thinking and the Remote Associates Test of convergent thinking. Relative to non-users, sober cannabis users self-reported higher creativity on the K-DOCS, and they performed significantly better on the Remote Associates Test of convergent thinking. No significant differences between cannabis users and non-users were detected on the CBI or Alternate Uses Test of divergent thinking. The results also revealed that relative to non-users, cannabis users were significantly higher in openness to experience and extraversion, and lower in conscientiousness. Finally, controlling for cannabis users' higher levels of openness to experience abolished the effects of cannabis on self-reported and objective creativity. Therefore, while cannabis users appear to demonstrate enhanced creativity, these effects are an artifact of their heightened levels of openness to experience.

1G: Results of the Cannabis Users Survey on Health 2016
Elyse Contreras, Colorado Department of Public Health and Environment, Marijuana Health Monitoring and Research Program

Background: Patterns of cannabis consumption have not been explored in detail among regular cannabis users within a legalized environment. We aimed to conduct a survey among regular cannabis users to collect detailed information on frequency of use, methods of use, amounts consumed, and adverse health effects experienced.

Methods: Data was collected via the Cannabis Users Survey on Health, a self-administered, anonymous online survey. Intended participants were adults (age 21+), residing in Colorado, who used cannabis at least once in the past month. Survey administration occurred June through October 2016.

Results: During the five-month administration period 1812 responses were recorded and 1297 were used in the analysis. Nearly two-thirds (65.2%) of participants used cannabis at least once daily. Smoking was the most common method of use (83.1%) and cannabis flower was the product most frequently purchased (n=1,006) and in the largest average amount per month (10 grams). About 40% of participants had ever experienced an adverse effect from use, the most prevalent effect experienced was paranoia (20%).

Conclusion: The Cannabis Users Survey on Health provided much needed data to inform ongoing public health surveillance on patterns of cannabis use in Colorado post-legalization. A high prevalence of daily use coupled with a high prevalence of smoking cannabis is concerning due to the potential for long term health effects. The prevalence of acute adverse effects from cannabis use demonstrated in this survey also underscores the need for more detailed surveillance to assess the severity of these effects. Continued data collection will allow public health to better assess the effects of increased cannabis product availability on use patterns and health.

1H: Fast Track Creation of FDA Compliant Cannabis Translational Medical Products: Ideation through R/D to Clinical Results—Tracked to Qualitative/ Quantitative Cannabinoid Content
Stephen Goldner, Pure Green , *John Althaus*, and *Debra Kimless*

We describe the methodology and clinical results obtained from sublingual tablets that disintegrate in 10 seconds with onset of effects in 90 seconds, lasting 4 to 8 hours. The tablets are consistent, reliable, convenient, portable, discreet to use and transport, patent-pending, organoleptically advantageous, and water soluble. This technology stack creates quantitative and qualitative cannabis clinical trial formulations directly linked to marketplace products with rigorous statistical analysis of human clinical trial data, resulting in superior marketplace outcomes.

The application of US pharmaceutical standards, known as GCX, to intra-state cannabis product development created clinical trial supplies and marketed cannabis products three logs better than current cannabis state standards (relatively rapidly at 18 months versus 7 years under FDA regulations). Research and development, as well as quality assurance processes to ensure compliance with FDA, ISO, MIL-STD and state regulations will be described. Ideation and process implementation are clarified, coupled to just-in-time business processes to yield favorable organizational outcomes.

We provide the model for fast-track product development of next generation cannabis products that embody FDA-compliant good clinical and manufacturing practices while creating unique and valuable cannabis consumer products.

2A: Cannabis as a Therapeutic Option for Chronic Pain Management, Curtailing the Opioid Addiction and Overdose Crisis: A Patient and Medical Perspective
Kyle Dijon Hill, Fight Opioid Addiction and Overdose with Medical Cannabis Project

The beginning of 2010 marked a time of significant increase in the availability, usage, and abuse of prescribed opioid medications, thus sparking the unprecedented drug overdose epidemic. The downfall to opioid addiction and overdose typically begins with the use of prescribed pharmaceutical opioids for the treatment of chronic pain. Chronic pain remains the leading condition for which opioids are prescribed. Despite opioid therapy being a mainstay approach for pain management, the usage remains controversial due to increasing concerns regarding side effects, efficacy, outcomes and high potential for abuse and addiction. One of the largest components of curtailing the opioid crisis is finding an alternative first-line treatment option for chronic pain; one that does not progress to dependence or overdose. Medical cannabis needs to be acknowledged as such an alternative. Current research suggests that cannabis, when used as adjunct therapy or as a substitute, results in a greater cumulative relief of pain, better quality of life, and a reduction in the morbidity and mortality associated with pharmaceutical opiates. Following the discovery of the endocannabinoid system, cannabinoid receptors CB1 and CB2 were identified. CB1 receptors are found in high concentration within the central nervous system, including areas that mediate the perception of pain. As cannabinoid receptors are absent from the brainstem, cannabis lacks the fatal opioid side effect of respiratory depression. After a car accident left me with fractured vertebrae among other injuries and severe chronic pain, I slowly became a victim to the unacknowledged devastation of opiates. As a medical student and a researcher within the realm of cannabinoid science, I provide a unique perspective of America's current situation of over prescribed and poorly monitored opiate pharmaceuticals. With the malignant nature of the opioid overdose crisis resulting in more than ninety Americans dying each day, it is due time we understand the reason fueling this crisis as well as generate viable solutions to curtail the destruction. By way of statistics, article reviews, comparative analyses, and a glimpse into countries and cities with established medical cannabis programs; a clear perspective is constructed and presented.

2B: An Informatics Research Agenda for Cannabis
Brian Keegan, University of Colorado at Boulder

As cannabis legalization accelerates across the United States and the world, the field of information science is uniquely positioned to provide guidance about the intersection of social and technical issues to help policymakers, entrepreneurs, and consumers. Sitting between the social science and computer science, information science is poised to help these diverse constituencies (1) understand how new social and cultural practices co-mingle with information technology design and use as well as (2) apply lessons from human-centered design and collaborative work to the design of new markets, regulations, and technologies.

Commercial cannabis entrepreneurs are collecting large and diverse kinds of data to improve their decision-making. What are social and technical barriers to the broader adoption of bioinformatics tools and methods? How do users track their consumption as a part of ""quantified self" practices?

Consumers are organizing online and offline communities to socialize together, market goods, and politically mobilize. How are existing platforms like Facebook, Amazon, or YouTube managing the presence of cannabis content in their community? How is the cannabis industry mobilizing customers to take political action? What new communities are emerging and what existing affordances are they adopting versus developing new interactivities?

Previously marginalized knowledge is being translated into formal systems to support innovation and collaboration. What breeding strategies, phenotypical traits, and other folk knowledge are translated into quantifiable metrics and reproducible processes? How can these self-reports be aggregated to make recommendations or be aligned with other data?

2B: Marijuana Research at the National Institute on Drug Abuse
Heather Kimmel, National Institute on Drug Abuse

While marijuana is illegal under federal law, most of the 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 ways to consume marijuana not previously seen before. We are 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 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 some of the marijuana policy research currently underway at NIDA described at ICR 2017, as well as information on available marijuana research opportunities in the context of overall NIDA priorities.

2B: Educating the Cannabis Chemists of Colorado: Cannabis Chemistry at CU-Denver
Vanessa Fishback, University of Colorado at Denver

The cannabis industry in Colorado is now a billion dollar business, growing 16% last year and employing 23,000 workers in the state. The emergent industry has a need for highly educated chemistry professionals for product development, laboratory analyses and basic research. CHEM 4421/CHEM 5421 at the University of Colorado-Denver provides undergraduates and graduate students with the specific organic chemistry, biochemistry, analytical chemistry and pharmacology education they need to participate in the growth of the industry. This training provides students with the background for developing quality analysis and control programs for a range of product types, running and refining extraction technologies, contributing to innovation in product development and to further our understanding of cannabis for medical purposes.

2C: A Community-Driven Research Approach to Developing Cannabis Appellations of Origin

Genine Coleman, Mendocino Appellations Project

The Mendocino Appellations Project (MAP) is a non-profit organization devoted to the research and development of legal appellation of origin protections for cannabis. Appellation of origin (AO) is a type of regional intellectual property right within geographical indication systems. Implemented correctly, AO protects the ecology, economic strength, and agricultural heritage of rural farming communities. The qualifying standards of an AO certification are derived from research of the unique environmental, cultural, and botanical aspects of the region's agriculture, which ensures an authentic provincial product of superior quality and enhanced market value.

MAP's objective is that a researched, standards-based AO system be adopted for cannabis in the United States, in order to most effectively protect our heritage cannabis farming communities and drive the further development of AO systems for all American agriculture. Cannabis is a very unusual American crop in that it has been shaped by 80 years of prohibition, only recently acknowledged in state legislation as agriculture. The history of cannabis prohibition has shaped very unique geographical circumstances, agricultural communities and practices. This agricultural legacy is currently under grave threat due to the challenges of state and local regulatory compliance, as well as continued federal prohibition. Currently the only appellation system in the United States, American Viticultural Areas (AVA), was established in the 1970s for American wine, which, like cannabis, was also influenced by a history of prohibition. However, AVAs are based solely upon provenance and carry no additional qualitative standards related to the product or practices therein. MAP's movement to develop a cannabis AO system, while influenced by the success of AVA, highlights the significance of research and qualitative standards which reflect and protect the shared values of heritage cannabis farming communities.

This presentation outlines MAP's adopted methodology of community-driven research in its work to establish AO, wherein reciprocal and equitable partnerships are pursued between various stakeholders of cannabis AO, involving cannabis farmers, organizations, and researchers. This includes environmental research for AO that examines the regional climate, topography, geology, watershed, flora, and soil composition; cultural research that examines the knowledge systems embedded in the agricultural traditions of regional farming communities, such as breeding, cultivation, and processing techniques, as well as land management practices; and, finally, botanical factors of the crop that are examined to understand how the region's environmental and cultural factors express through the crop that is produced.

The aim is to increase knowledge and understanding of our rural cannabis farming communities and integrate the knowledge gained within policy and social change in order to secure the legacy of heritage cannabis agriculture in America.

2C: Study of Industrial Hemp as Filler Material in ABS Filament Composites for 3D Printing FFF AM Process

Nebojsa Jaksic, Colorado State University-Pueblo

Fused Filament Fabrication (FFF) is a popular prototyping and manufacturing 3D printing process based on material addition. It belongs to a group of additive manufacturing (AM) processes whereby an object is created by adding material. FFF extrudes filament material through a small-diameter nozzle and deposits it in layers thus building an object. Acrylonitrile Butadiene Styrene (ABS) and Polylactic Acid (PLA) are the two most often used plastic materials in FFF. Both materials are recyclable. However, while PLA is a biodegradable and environmentally-friendly material, ABS is not. ABS is created through a chemical reaction of petrochemical compounds and is not easy to decompose. This research investigates hemp as filler material in hemp-ABS composites used as filament in FFF processes. In particular, the research explores mechanical and chemical properties of ABS plastic filament composites with industrial hemp as filler material. Since hemp is less expensive than ABS and is environmentally friendly the hemp-to-ABS ratio is optimized with respect to FFF process parameters (extruding temperature, nozzle diameter, filament fragility, etc.) and the created objects' characteristics such as tensile and compressive strength, hardness, and geometrical precision.

2D: Running Numbers: An Analysis of the Three Primary Campaign Theories and Where Colorado Stands Five Years After Legalization

Andrew Livingston, Vicente Sederberg LLC

To better understand the effects of legalization on Colorado communities, the three primary talking points of the successful Amendment 64 cannabis legalization campaign were analyzed with data from before and after Colorado cannabis businesses began selling cannabis to all adults twenty-one and older. The three talking points relevant to this analysis are: (1) efficient use of law enforcement resources; (2) creation of new tax revenue and employment; and (3) the beneficial social outcomes resulting from marijuana and alcohol substitution.

Colorado's Amendment 64 campaign claimed that legalization of cannabis would allow police to focus their scarce resources on more important violent and predatory crimes. As a result of changes in criminal law, the total number of charges filed in court for marijuana possession, distribution, and cultivation in Colorado fell from 10,236 in 2010 to 2,036 in 2014. Still, the impact on police utilization of resources for the prevention and enforcement of violent and predatory crime is less clear. Many law enforcement agencies in the state claim that cannabis legalization has increased confusion and costs for their officers and has not reduced their need for resources.

One of the primary talking points of the legalization campaign was the first 40 million dollars in cannabis excise taxes were to be earmarked for Colorado school construction. Since the start of adult-use cannabis sales in 2014, Colorado has generated over $500 million in state cannabis taxes and estimates for the number of individuals employed in the industry range from 20 to 30 thousand, four times more than all individuals employed in farming, fishing, and forestry occupations in the state.

Beneficial social outcomes resulting from marijuana and alcohol substitution are more difficult to quantify. Although recent industry investor reports have created concern for beer manufacturers, total alcohol excise taxes in Colorado have climbed every year from 2013 through 2016.

Over five years since voters passed cannabis legalization, and about four years since the first adult-use stores began to open, Colorado communities are witnessing distinct benefits from tax revenues and thousands of new jobs. But beneficial societal change in the form of police issue re-prioritization and alcohol-marijuana substitution may take longer to fully assess.

2E: The Next Jim Crow: Reproducing Old Time Racism in New Cannabis Frontiers
Timothy McGettigan, Colorado State University-Pueblo

The War on Drugs has been a war on people of color. Cannabis has been legalized in Colorado, but people of color are still being criminalized for cannabis use and possession at higher rates than their white counterparts. There is mounting evidence that the same old prejudices are taking root in new legal cannabis frontiers.

2F: 2017 to 2018: What's New with the "Legal" Status of Cannabis? A Review of Changes at the Federal Level
Linda Schutjer, Colorado State University

Since last years conference there has been significant changes in the legal landscape with respect to industrial hemp and high THC cannabis. Attorney General Sessions appointment to head the Department of Justice has lead to a withdrawal of the "Cole memo" which had previously guided the DOJ in its application of the Controlled Substances Act to marijuana users and those in the medical marijuana and hemp industries. The Cole guidance has provided some comfort to users and growers that as long as they acted in compliance with applicable state laws, the risk of arrest and prosecution was low. While congress has included a measure blocking use of government funds to prosecute those otherwise in compliance with their state medical marijuana and hemp laws in each budget since 2014, it is unclear that the administration will honor it. Other regulatory actions have suggested that even medical use of CBDs could face DOJ action, even where it would seem that such use is permissible under Farm Bill provisions. Given these and other actions and statements from Washington DC, an update on the legal status of hemp and high THC cannabis—what we know, don't know and suspect or expect would be timely and useful information.

2G: Unsafe Driving Behaviors After Using Marijuana and Other Substances among High School Seniors: Monitoring the Future, 2006–2016
Steven Curry, BLH Technologies

The legalization of medical or recreational marijuana in 29 states and the District of Columbia has raised concerns about the effects of marijuana use on driving safety. Evidence suggests marijuana-impaired driving may be increasing; according to the U.S. National Roadside Survey, drivers testing positive for marijuana increased from 8.6 percent in 2007 to 12.6 percent in 2014. Laboratory and epidemiological studies indicated that marijuana use could compromise psychomotor functions and increase the risk of vehicle accidents, particularly among youth. From 2001–2011, approximately 20 to 25 percent of high school seniors reported that within the past 2 weeks they drove a vehicle after smoking marijuana or were a passenger of a vehicle after the driver had smoked marijuana. This study is a continuation of work done by Terry-McElrath et al. (2014), which used Monitoring the Future data to examine self-reported marijuana use patterns associated with unsafe driving behaviors (driving or riding in a vehicle after marijuana use) among a national probability sample of high school seniors from 1976–2011. We will examine those same associations for the period 2006–2016, which coincides with the legalization of marijuana in several states. Additionally, we will investigate the associations between marijuana harm perceptions and unsafe driving behaviors. Our preliminary findings indicate that the percentage of high school

seniors reporting unsafe driving behaviors within the past 2 weeks as it relates to marijuana use has remained relatively stable over time; approximately 25 percent of seniors reported driving after using marijuana or reporting being a passenger after the driver had used marijuana. Additionally, our findings indicate that respondents who have a low harm perception of regular marijuana use are almost five times more likely to report engaging in unsafe driving behaviors. This research will help to inform the discussion of the effects of marijuana use on driving safety among youth, and contribute to improved policy and personal decisions. Our research will also highlight the need for comprehensive and systematic surveillance of population behavior changes over the course of marijuana legalization.

2G: Chronic Cannabis Users Demonstrate Blunted Stress Reactivity
Carrie Cuttler, Washington State University

One of the most commonly cited reasons for chronic cannabis use is to cope with stress and previous research suggests that cannabis users demonstrate reduced emotional arousal and dampened stress reactivity in response to negative imagery. However, to our knowledge, the present study represents the first to examine the effects of an acute stress manipulation on subjective stress and salivary cortisol in chronic cannabis users compared to non-users. 40 cannabis users and 42 non-users were randomly assigned to complete either the stress or no stress conditions of the Maastricht Acute Stress Test (MAST). Those in the stress condition were required to place their hand in an ice bath and perform math under conditions of social evaluation. Those in the no stress condition had to place their hand in lukewarm water and count from 1 to 25. All participants gave baseline subjective stress ratings before, during, and after the stress manipulation. Cortisol was measured from saliva samples obtained before and after the stress manipulation. Further, cannabis cravings and symptoms of withdrawal were measured. The results showed that subjective stress ratings and cortisol levels were significantly higher in non-users in the stress condition relative to non-users in the no stress condition. In contrast, cannabis users in the stress condition showed no increase in cortisol and a significantly smaller increase in subjective stress ratings. The stress manipulation had no impact on cannabis users' self-reported cravings or withdrawal symptoms. The results indicate that chronic cannabis use is associated with blunted stress reactivity. Future research is needed to determine whether this helps to confer resiliency or vulnerability to stress-related psychopathology as well as the mechanisms underlying this effect.

2G: Impaired Driving and Cannabis: Media Reporting from Health Studies and Academic Research
Lloyd Covens, West420 NewsWeekly

Driving under the influence of medical or adult-use cannabis continues to be a concern for marijuana policy in North America. News reporting on the impairment measurements around blood, saliva or breath tests has entered the mass media, and is also critical in the science and health problems of expanded cannabis access. This paper will examine the social, science and individual dimensions of impaired cannabis driving behaviors, as reported by select major media, and compares news reports of both academic research and government studies. The analysis will shed light on varied approaches to public communications, comparative detection techniques, and reporting on law

enforcement goals for safe driving in the age of greater cannabis use.

3A: Less Is More: Exploring the Science of Microdosing
Dorothy Colagiovanni, Next Frontier Biosciences

Microdosing is the practice of using very small amounts of cannabis to experience its benefits—in essence, receiving the maximum benefit from the minimum amount of product. Microdosing is ideal for those who wish to maintain optimal health and wellness. This approach can offer a range of therapeutic advantages, with consumers turning to microdosing as a way to relax and elevate their mood. The main advantage of microdosing is that it allows the cannabis consumer to achieve desired results without experiencing paranoia or lethargy.

This session will provide a thorough background on what microdosing is and why it is beneficial, drawing support from clinical, laboratory, and consumer experiences. In addition, the panel will discuss how the optimal microdose can be successfully achieved, and finally, how this practice will play into the rapidly evolving future of the industry.

3B: Cannabinoids and Terpenoids: A Balanced Look at an Expanded Perspective of the Entourage Effect
James Parco, Colorado College, Mesa Organics, Purplebee's

With the expansion of cannabis legalization, an increased interest has simultaneously emerged on maximize use effects for consumers who elect to use cannabis as a source of treatment. Up until now, the primary focus has been almost exclusively on the commonly known cannabinoids of tetrahydrocannabinol, and more recently, cannabidiol. We hypothesize that the experienced efficacy of cannabinoid synthesis is moderated by the other primary class of compounds known as terpenoids, or colloquially, terpenes. We exposit a descriptive analysis of both classes of compounds and pose questions of future research efforts on both classes based on emerging evidence through a phenomenological revelatory case study.

3C: Spatial Distribution of Cannabinoids, Terpenes, and Others within Agricultural Cannabis Products
Joseph Diverdi, XTR Systems, LLC, Colorado State University, and *Twinkle Paryani*

Agricultural products are, by their very nature, inhomogeneous in many ways and on many size scales. Some products destined for human use and consumption are used in their entirety and others are blended. Cannabis is no different in this regard, yet it appears that common systems of production, processing, analysis and final use do not take this heterogeneity fully into account and may be impacted by this failure. The work presented here exposes a fundamental characteristic of cannabis in this light: the initial agricultural product at the beginning of this supply, production, consumption and treatment chain ("flower" or "bud") is intrinsically and significantly inhomogeneous in important characteristics and this can materially affect our models, quantitative evidence of benefit and harm and elsewhere.

3C: Sensory and Chemical Analysis of Cannabis Aroma
Joseph Diverdi, XTR Systems, LLC, Colorado State University, and *Avery Gilbert*

Until recently, research on cannabis aroma has been exclusively conducted by means of analytical chemistry. The results have demonstrated that the majority of volatile compounds consist of mono- and sesquiterpenes, a relatively small number of which turn up consistently across different cannabis strains. While a chemical accounting is informative, and may enable "chemotyping" of specific strains, it does not by itself provide a precise description of a strain's olfactory character. For this, sensory evaluation by human odor panelists is required, either as a stand-alone technique or in combination with GC/MS-olfactometry. Given the importance of strain aroma to user experience, marketing, and product development, it is worth considering the relative advantages of chemical and sensory methods in defining and communicating about cannabis strain aroma.

3C: A Technology Assessment of Leading Cannabis Tracking Systems
Kevin Lang, The Global Element, LLC

Diversions of cannabis products to the black market continues to plague the industry because barcodes can easily be separated from products. Diversion of legal cannabis products to the black market is severely limiting collection of cannabis taxes and is considered a priority problem requiring a solution by state and federal regulators alike.

Advanced technology companies are currently developing revolutionary cannabis tracking systems that utilize an "agent" applied directly to cannabis plants and products; are invisible to the unaided eye and cannot be separated from cannabis products. The best available "agent" that is safe for cannabis workers, consumers and the environment alike must be identified.

This presentation will compare and contrast the most advanced cannabis tracking technologies and systems currently in use and under development in the cannabis industry. The goal of the presentation is to provide a framework to identify the best available cannabis tracking technology available today that solves the cannabis diversion problem, and optimizes state cannabis revenues.

Specifically, barcode based cannabis tracking systems, Nano Silica Taggant based cannabis tracking systems, and DNA Molecular Marker based cannabis tracking systems are included in this technology assessment. The presentation will describe the many technical differences between these systems and compare and contrast them from the perspective of utility, safety, reliability, security, and cost.

The presentation concludes with the presenter leading a panel of cannabis tracking system experts engaging conference participants in a Q&A discussion session.

3D: The Integration of Research, Development, and Analytics along the Cannabis Supply Chain
Adam Rahman, Acculliance

Within the cannabis industry there are various sectors of the seed to sale supply chain that many business professionals overlook while attempting to improve their product and distribution channels. We believe it is imperative that the analytics and overall understanding of the commodity under production is carefully integrated and influential in forming the direction of successful wholesale or retail channels. Our vision is to assemble an appropriate and valuable consulting firm that can provide the tools, knowledge, and connections necessary for the integration of analytics into the various verticals within each business' supply chain. Full vertical integration can be challenging without proper consulting and can even become too complicated to systematically handle. Utilizing an intermediary service that can handle the stress of analytic based issues with product is an invaluable tool. This

will open up a new network of professionals that can integrate ideas and applications from each area of expertise easily and transparently. Research, development and analytics together provide credibility and direction for the formation of long term relationships paralleled with the demand of our evolving industry. We aim to channel and apply the knowledge gained through accredited cannabinoid research to improve the cultivation, extraction, manufacturing, and sale of cannabinoid products. It is evident that there is a disconnect between the medical and economical side of the cannabis industry, and proper transparency and integration between both areas is vital. Establishing an intermediary network of professional consultants can act as an effective liaison between medical projects and economic ventures. Ideally, we strive to see both avenues integrate and progress in parallel to provide the patients and end consumers with the buying security and authenticity that research, development and analytics provide.

3E: The Cannabis Conversation—Let's Hash It Out: A Blunt Discussion About Cannabis Impaired Driving
Sam Cole, Colorado Department of Transportation

The Colorado Department of Transportation (CDOT) will host a panel of traffic safety and marijuana industry experts to discuss how the state is responding to cannabis impaired driving since legalization in 2014. Panelists will present how crash data is collected and discuss the applications and constraints of doing so. The panel will explore scientific, behavioral, legal, economic and social elements tied to cannabis impaired driving and its application to statewide traffic safety campaigns, including the recently launched Cannabis Conversation public engagement effort. The panel will present data, including longitudinal data, on marijuana-involved traffic crashes, arrests, and fatalities, and self-reported data on cannabis use, opinions and behaviors from CDOT's annual mail survey and the Cannabis Conversation survey research. The panel will discuss the following questions:

1. What are the challenges in using and collecting data on driving under the influence of cannabis? How can more or improved data help?
2. How have state agencies in Colorado responded to cannabis impaired driving since legalization? What new programs have been adapted or created?
3. Given the data we have, why do varying opinions persist regarding the dangers of driving under the influence cannabis? How can we change social norms to see drugged driving as dangerous as drunk driving?

3F: Interpretations of the Farm Bill: The Differences Between States and How That Impacts an Emerging Industry
Duane Sinning, Colorado Department of Agriculture

Since the passage of the Agricultural Act of 2014 or the 2014 Farm Bill, at least 34 states have passed legislation related to industrial hemp. The Farm Bill defined industrial hemp, laid the groundwork for who could cultivate industrial hemp, and provided guidance on what could be done with the material grown. So why are the regulations so different between states?

To understand the impact regulations play on this emerging industry you first need to understand how different states interpreted the Farm Bill. Why do some states require criminal background checks and others don't? Why do some states regulate only cultivation and other states regulate the industry from planting to retail? But on an even more fundamental approach, why don't all states even agree on what qualifies as industrial hemp and how does that impact the emergence of this new industry.

This talk will touch upon how states came to develop such different regulations, all with the belief that their programs were Farm Bill compliant. It will touch on the lack of uniform information states receive from their federal partners and how not all federal agencies are uniformly applying their own regulations to industrial hemp. And the talk will take a look at what impact the lack of standardization in regulations has on this emerging industry as it looks for legitimacy.

3G: The Relationship Between Cannabis and Homelessness
Donald Burnes, Burnes Center on Poverty and Homelessness

With the advent of medical marijuana in Colorado in 2010 and legalized recreational marijuana in 2014, there has been a growing debate about whether marijuana has created an increase in homelessness, both locally here in the Denver metropolitan area and across the state. Described slightly differently, is there a relationship between legalized recreational cannabis and homelessness? Various individuals and organizations have weighed in on this issue from a wide variety of perspectives, and there are stories and claims on both sides of the argument. This paper will lay out the best available evidence about this topic.

3G: Policing the Black Body: Police Profiling of Blacks Looking for Marijuana (and Other) Illegal Drug Use
Earl Smith, George Mason University

This presentation is a preliminary examination of racial disparities in policing, with a specific focus on marijuana possession. We provide data that confirm that despite similar rates of use of marijuana for both whites and African Americans that African Americans are overly represented in the stops by police, convictions, and sentences to confinement. We situate these data in a larger discussion of Nixon's racialized War on Drugs.

Marijuana use is legal—to some extent—in approximately 40 states. This legality is either medical use and/or recreational use. At the end of the day, though, marijuana use, abuse, sale and distribution is still largely illegal in the United States and this leads to serious confusion on the part of the public.

For this presentation Washington D.C., lends itself as a good example for this report in that it is one of few states (DC is not a state but legally it is a federal district) where it is legal to consume marijuana (2 ounces) in the privacy of one's home. This begs the question for those who are homeless and those whose domicile is public housing, two groups who are, in DC as elsewhere in the United States, and disproportionately Black.

It is the hope of this research to empirically demonstrate that drug policies that began in the Richard Nixon era (1968–1972) and have been sustained into the Jeff Sessions era (2017–) have been a major contributor to the rise in the mass incarceration of black people, primarily for low-level drug offenses.

3G: An Analysis of News Coverage of the Cannabis Industry in Southern Colorado
Elizabeth Viall, Colorado State University-Pueblo, and *Joanne Gula*, Colorado State University-Pueblo

Colorado was the first state to legalize recreational marijuana on November 6, 2012. This study examines editorial content published

by the *Pueblo Chieftain*, which is the daily newspaper located in the largest city in southern Colorado. The study spans a period from mid-2016 to mid-2017 surrounding a ballot measure issue which, approved in November 2016, allowed for recreational sales of cannabis in the city of Pueblo. Prior to this recreational sales were only legal in the county. Both the city and county of Pueblo have growing industries as well as legal dispensaries. This content analysis looked at news stories, editorials, and photographs relating to cannabis. Editorial content was coded for length, topic, placement on page, and pro or con support for this new issue.

3H: Subunit-Selective NMDA Receptor Modulation by a Non-Psychoactive Cannabinoid Analog Dexanabinol (HU-211)
Elijah Ullman, University of Montana

NMDA-type glutamate receptors are ligand-gated ion channels that mediate a component of excitatory neurotransmission. Malfunctions in NMDA receptor activity are implicated in many neurological diseases, including neurodegenerative disorders and epilepsies. Most NMDA receptors are tetrameric assemblies of two GluN1 and two GluN2 subunits. Glutamate and glycine are co-agonists of the NMDA receptor with glycine binding to the GluN1 subunit and glutamate binding to the GluN2A-D subunits.

Cannabinoids, such as cannabidiol, are known anti-epileptics, but the mechanism of action is unresolved. The cannabinoid HU-211 (dexanabinol) lacks CB1 or CB2 receptor activity, but has been shown to have antiseizure activity and neuroprotective effects. By contrast, the enantiomer HU-210 is a potent, full agonist of CB1, but lacks antiseizure activity and neuroprotective effects. Interestingly, HU-211 is known to be a noncompetitive NMDA receptor antagonist, but the mechanism of action, subunit-selectivity, and binding site are unknown. HU-211 is brain penetrable and non-psychoactive. We hypothesize that such properties provide promise of HU-211 as a potential therapeutic agent for NMDA receptor modulation and the objective of this study is to further evaluate the molecular mechanisms of the effects of HU-211 at NMDA receptors.

3H: Impact of Legal Cannabis on the Child Welfare System
Arlene Reilly-Sandoval, Colorado State University-Pueblo

In the past five years, laws centered on the possession, sale, and transfer of medicinal and recreational cannabis have changed drastically. Penalties for cannabis possession can include mandatory prison sentences, fines, and loss of government family aid, drastically altering the lives of those caught with cannabis, and leaving a secondary impact on their families. When a parent is charged with a drug offense, the consequences they face tend to trickle down to their children and Child Protective Service (CPS) involvement is common. CPS involvement can stem from the drug use itself or occur from abuse or neglect issues that arise from the ingestion of substances that affect cognition or physical health.

This study looked at the impact of cannabis legalization within the CPS system in Pueblo County, Colorado. The number of Child Welfare (CW) referrals and amount of Core dollars spent on substance abuse treatment were collected for the years 2012–2017, and four CW workers were interviewed regarding their experience with families who use cannabis as compared to families who do not, and the challenges experienced when working with families who are cannabis-involved. Each CW worker came from a different unit within the Department

of Social Services (i.e., intake, adolescent services, foster care, truancy) in order to include the largest client population possible.

Initial results showed a surge in referrals and core dollars spent on substance abuse treatment programs immediately after cannabis legalization, but a decrease in the number of children removed from a home for parental drug or alcohol abuse. Interviews from CW workers indicated that parents were more likely to disclose cannabis use than use of any other drug. Interviews also revealed an anecdotal belief among CW workers that homeless families have increased in Pueblo and revealed a lack of guidance for caseworkers regarding when to remove children or reunify families when cannabis is the only substance involved.

The subject of cannabis legalization and child welfare is multi-faceted, and further complicated by issues such as poverty, citizenship status, unemployment, homelessness, availability of safety net benefits, and mental health challenges that are experienced by families referred to Pueblo County Department of Social Services. This poster presentation will describe the data collected and provide recommendations for policy changes and suggestions for future research.

3H: Alterations to Mitochondrial Metabolic Pathways During Cannabinoid Activation of CB1 Receptors within Human Hepatocytes
Juan L. Rodriguez, Colorado State University-Pueblo

The endocannabinoid system is found throughout the entire body and comprises endocannabinoid ligands, cannabinoid receptors, and biochemical enzymes for their synthesis and degradation. In previous work, cannabinoid receptors have been found throughout the body including the liver. Activation of these CB receptors results in significant changes to cellular pathways. Interestingly, the CB1 receptor was previously thought to only be present at the cellular membrane, but it is becoming apparent that CB receptors also exist on the mitochondrial membrane where interactions with ligands can mediate a rapid response on cellular respiration. CB1 ligands are lipid-derived compounds which regulate processes such as gluconeogenesis, fatty acid oxidation, and oxidative stress. Arachidonyl-2'-chloroethylamide (ACEA) an agonist and AM-251 an inverse agonist are synthetic CB1 ligands. The powerhouse of the cell is notably the mitochondria that supply the energy demand of the cell. Mitochondria dysfunction can be induced with changes to cellular physiology relating to loss of electron transport chain maintenance with decreased electrical transmembrane potential in the inner mitochondrial membrane, altered electron transport function, and reduced energetic metabolites abilities to cross the mitochondrial membrane. Dysfunction is measured by the reduced oxidative phosphorylation process with low levels of ATP produced. In our study, we aimed to evaluate human liver hepatocytes (HuH7.5 cells) and measure how cannabinoid activation alters bioenergetics changes in basal respiration, maximum respiration, non-mitochondrial respiration, ATP production, coupling efficiency, proton leak and spare respiratory capacity with treatments at 100nM ACEA and AM-251. Using an Agilent Seahorse XFe24 real-time metabolic analyzer, we found evidence of modified mitochondrial function in cannabinoid-treated HuH7.5 cells. Procedures were done to inhibit the electron transport chain while monitoring oxygen consumption rate and extracellular acidification rate in real-time. Mitochondrial pathways were targeted unwinding responses from CB1 activation with two synthetic compounds. Basal respiration, maximum respira-

tion, and ATP production had a higher rate during treatment with both ACEA and AM251. Increased levels of ATP production demonstrate the energy demand needed from the mitochondria supplying CB1 induced pathways. CB1 activation with ACEA and AM251 had altered effects on the mitochondria changing cellular physiology.

3H: CB2 Mediated Antiviral Activity in Hepatocytes
Joseph Lopez, Colorado State University-Pueblo

Alphaviruses are small, spherical, enveloped, single stranded positive-sense RNA viruses responsible for a substantial range of human and animal diseases. Viral infection can cause arthritis or encephalitis, resulting in a significant medical burden. Furthermore, alphaviruses have spread rapidly due to the globalization of their mosquito vectors and have become a global health concern, exemplified by the recent Chikungunya virus outbreaks in South and Central America. All viruses are obligate cellular parasites that require host cell machinery to generate progeny. They accomplish this by hijacking the host cells physiological pathways, which have drastic consequences on both viral replication and cell viability. Cannabinoids are endogenous lipid mediators that exert many of their effects through cannabinoid receptor-1 (CB1) and cannabinoid receptor-2 (CB2). Interestingly, exogenous cannabinoids and many synthetic CBR specific agonists and antagonists have been implicated in many cellular and systemic host responses; resulting in significant research and development regarding CBRs as possible therapeutic interventions. Specifically, CBR activity may modulate ideal cellular pathways to significantly impact viral replication. We have previously reported the antiviral impacts associated with CB1 agonists and antagonists ACEA and AM-251, respectively. In our current study, we have expanded the project to include CB2 selective agonists (AM-1241, SR-144-528) to determine their impact on alphavirus replication. We hypothesize that the CB2 receptor activity will directly modify host cell physiology, significantly impacting viral replication. This project attempts to provide additional information pertaining to the use of medicinal cannabis against viral infections and the results will add to the knowledge base in fields within the academic, cannabis, virology, and public health communities.

3H: Cannabidiol (CBD) Increases Survival Rate of Ethanol-Treated Tobacco Hornworms (*Manduca Sexta*) by Alleviating Ethanol-Toxicity
Kyle Staples, Colorado State University-Pueblo

Cannabis sativa, also known as marijuana, produces at least 120 cannabinoids. Cannabidiol (CBD) is the most prevalent non-psychoactive compound that is accumulated in the glandular trichomes of female flower. Cannabidiol has shown promise as a potential therapeutic agent on numerous human diseases. In this research, the authors propose a protective function of CBD against ethanol (EtOH) in tobacco hornworms (*Manduca sexta*). Our insect feeding assay indicates that the increase of EtOH toxicity is negatively correlated with insect development (larval growth) and behaviors (diet consumption and mobility). The artificial diet (AD) containing >1% EtOH appeared to be lethal. However, when 2mM CBD was administered, the survival rate increased by ~40% comparing to insects reared on 2% EtOH diet. In addition, the CBD-administered insects outperformed EtOH only-treated insects. The 1mM CBD-treated insects present ~78% size and ~710% weight increase than those of insects grown on 1% EtOH diet. Furthermore, 1mM CBD administration increases diet con-

sumption (~500%, p<0.05) and mobility (~53%, p>0.05) comparing to 1% EtOH-fed control insects. The electrophysiology results also reveal that CBD treatments effect electric response (mV) of the ganglion central nerve system in a tobacco hornworm. The 1mM CBD-treated ganglia responded more rapid with electric stimuli, the response was 2.37mV while the electric response of ganglia from hornworms reared on AD was 0.87mV, and AD+1%EtOH diet was 1.57mV. This may indicate the presence of CBD receptor in an invertebrate system. Our study presented here reveals the protective effects of CBD on the EtOH-intoxicated tobacco hornworms, leading to an increased survival rate.

3H: The Effects of 2-Arachidonoylglycerol, Anandamide, and 17Beta-Estradiol on Osteogenesis in Cultured Primary Human Osteoblasts
Derrick Williams, Colorado State University-Pueblo

Postmenopausal osteoporosis develops when bone removal by osteoclasts exceeds bone formation by osteoblasts due, in part, to low estrogen. Activation of the cannabinoid receptor type 1 (CB1) and type 2 (CB2) might influence estrogen's osteogenic effects in mature osteoblasts, but few studies have examined this interaction. We hypothesize that activation of CB1 and CB2 receptors in primary human osteoblasts (HOB) with endogenous endocannabinoids, AEA and 2-AG, will influence the osteogenic effects of estrogen in vitro. To test this hypothesis, HOBs will be cultured in media with increasing concentrations of 17beta-estradiol, 2-AG, and AEA for between 1 and 24 days. The responses of HOBs to single drug treatments will first be studied, followed by treatments with endocannabinoids in combination with 17beta-estradiol. After seeding the cells, proliferation will be measured by DNA content. Once confluence is reached, HOBs begin osteogenesis by secreting collagen-containing organic matrix and calcium-containing inorganic matrix. Osteogenesis in the presence of 17beta-estradiol and/or endocannabinoid will be measured by determining alkaline phosphatase activity, extracellular matrix collagen content and calcium deposits. At present, in control studies we have determined that the HOBs proliferate at relatively slow rates in the absence of 17beta-estradiol and/or endocannabinoids (2-AG, AEA). They appear to reach senescence after about the fourth passage in cell culture. Thereafter, they appear to not effectively produce mineralized extracellular matrix and have little to no alkaline phosphatase activity. New studies will focus on using HOBs from an earlier passage as a model for testing the proposed hypothesis.

3H: The Path from Plant to Products: Preparation of Nature Identical Cannabis Extracts
Jacqueline Harding, Cannabistry Labs

Cannabis extracts are evaluated by the potency, color, yield, and the capacity to mimic the natural flower profile. The outcome of the final extract product is highly dependent upon the extraction method and subsequent post processing techniques. The research presented here will examine the optimization of supercritical fluid CO_2 extraction parameters and purification processes on the impact of extract yields, removal of coextraction products, and potency to produce high grade cannabinoid extracts. Our approach emphasizes the selective extraction and isolation of terpenes and cannabinoids from Cannabis flower supported by rigorous analytical methods. We will present our results for the isolation and purification of terpene ex-

tracts without requiring additional heat that mimics the natural profile of whole plant terpenes. For the extraction of cannabinoids our methods demonstrate complete cannabinoid extraction efficiency and the tunable coextraction of chlorophyll. In tandem, we will present our results of our developed methodology for the purification of the cannabinoid extract to remove coextraction products including chlorophyll without requiring high temperature distillation and minimal loss of cannabinoids. The methodologies described here facilitate the preparation of high grade oil extracts that can be directly utilized in formulated products including vape cartridges without the need for non-natural diluents. As a result, formulated products can be implemented without the need of flavor masking agents and can be tuned to mimic the natural flavor and efficacy profiles of cannabis flower.

3I: Cannabis Use Patterns and Methods of Administration among Virginia Adolescent Cigarette Smokers and Nonsmokers
Caroline Cobb, Virginia Commonwealth University

Significance: Despite the range of cannabis administration methods, limited data is available regarding their prevalence, particularly among adolescents. Such data could inform prevention/policy, given that administration methods may present differential health risks. This study measured cannabis use patterns and methods in an adolescent sample with varying tobacco use.

Methods: Virginia adolescents (community-sampled in 2016–17) aged 13–18 years old (yo; n=1,110) who were either past 30-day cigarette smokers (CS; 54%) or tobacco-susceptible non-smokers (NS; 46%) completed an in-person survey as part of a larger study of electronic cigarette (ECIG) advertising. Baseline cannabis use measures included ever, past 30-day, and past 30-day method frequency (joint/spliff, bong/bowl/pipe, blunt, ECIG+oil, ECIG+wax, vaporizer+dried cannabis [VAP], edible, other). Descriptive and bivariate analyses examined past 30-day cannabis measures by age and CS.

Results: Overall, 54% reported past 30-day cannabis use with a greater proportion among 18 yo (68%) vs. 13-17 yo (42%) and CS (77%) vs. NS (42%; ps<0.05). Cannabis users reported on average 12 days/month and 2 methods/month. Combusted methods were the most frequent, blunt (76%), joint/spliff (52%), bong/bowl/pipe (41%), followed by edible (23%), VAP (11%), ECIG+oil (8%), ECIG+wax (7%), other (5%). Relative to 13-17 yo, 18 yo reported more methods/month and greater bong/bowl/pipe, ECIG+wax, and edible use (ps<0.05). Relative to NS, CS reported more days/month and methods/month and greater bong/bowl/pipe, ECIG+oil, ECIG+wax, and VAP use (ps<0.05).

Conclusions: Adolescents are utilizing diverse cannabis use methods, and cannabis use intensity is associated with concurrent CS. Addressing motivations or risk for certain methods will be essential for informing cannabis prevention and policy.

3I: Genotype-By-Environment Interactions of Economically Relevant Traits in Industrial Hemp (*Cannabis Sativa*)
Brian Campbell, Colorado State University

As hemp (*Cannabis sativa*) is re-introduced as an industrial crop in the United States, understanding genetic mechanisms controlling economically relevant traits is necessary to create a sustainable supply chain. In addition, with legality of the crop hinging on a stringent tetrahydrocannabinol (THC) content of 0.3% or less, it is necessary to understand genotype-by-environment interactions (GEI) to avoid

running afoul of the law. To what degree does variation in the environment influence THC and other cannabinoids and how do genotypes vary in their sensitivity to the environment are important questions regarding production and regulation of industrial hemp. Understanding how agronomic traits respond to the environment also plays a strong role in selecting and developing appropriate cultivars for production in Colorado's diverse growing regions. With these motivations, the purpose of this study is to assess performance characteristics and dissect variance components of key traits to better understand the stability and plasticity of industrial hemp cultivars.

Throughout 2015 and 2016 we performed variety trials in multiple environments in Colorado to assess many different performance characteristics of a diverse set of germplasm from breeding programs across Europe and Asia. The traits measured ranged from agronomic traits like seed yield, biomass, or days to maturity, to biochemical traits like cannabinoid and terpene production and carbon isotope discrimination. In our trials, we observed variation both within and among cultivars, reflecting the genetic diversity present in the species. From these data, we were able to identify traits nearly entirely controlled by genetic factors, as well as traits strongly influenced by the environment and GEI. Individual cultivars exhibited widely varying degrees of sensitivity to the environment. This underscores the importance of continued work to characterize genetic control of traits to expedite breeding of cultivars that are well-adapted to target growing regions. This collaborative approach between geneticists, plant breeders, and agronomists is helping transform industrial hemp into a viable alternative crop for Colorado farmers and beyond.

3I: Differential Effects on Cognitive versus Reflexive Memory Recall After Cannabidiol Treatment
Amy Uhernik, Colorado State University-Pueblo

Cannabidiol (CBD), a constituent of the *Cannabis sativa* plant, is thought to have therapeutic potential for treating psychiatric conditions, including anxiety and post-traumatic stress disorders (PTSD) that involve cognitive and reflexive aspects of the learning and memory process. Studies have shown that CBD enhances extinction of fear memory, and has other memory enhancing properties. Cognitive and reflexive aspects of learning and memory can be modeled by Pavlovian fear learning and memory studies in which a fear memory is formed by pairing a neutral conditioning stimulus (CS) with a noxious unconditional stimulus (US). The level of cognitive demand placed on the learning and memory process is dependent on the temporal characteristics of the CS-US pairing. In the current study, we hypothesized that cannabidiol, a putative therapeutic for treating anxiety disorders, including PTSD, would have a differential effect on the recall of cognitive versus reflexive memories. To test this, we measured the effects of CBD on the recall of fear memories induced by conditioning protocols in which CS-US pairing was varied to alter the level of cognitive demand. Our results show that CBD may have a greater effect on recall of cognitive memory than reflexive memory. This is important because it narrows the range of possible mechanisms to evaluate in the future development of CBD as therapeutic for a range of psychological conditions including PTSD.

3I: Cannabidiol During Acquisition Mildly Affects Fear Learning and Memory in Mice
Zackary Montoya, Colorado State University-Pueblo

Cannabidiol (CBD), a constituent of the *Cannabis sativa* plant, is reported to have therapeutic potential for treating psychiatric conditions that affect learning and memory, including anxiety and post-traumatic stress disorders (PTSD). Pre-clinical fear-learning and memory experiments in rodents have shown extinction memory-enhancing effects of CBD when administered just prior to extinction training. This suggests potential for CBD as a therapeutic that could enhance the efficacy of exposure therapy. However, we have recently shown that CBD can also enhance the de novo acquisition of fear memories in male mice when administered prior to fear conditioning. This suggests a counter indication for CBD when taken in a setting with the potential for new fear-memories to be acquired. In the current study, because anxiety disorders including PTSD, are more prevalent among women, we repeated this work using female mice. The research design utilized different types of auditory-cued Pavlovian conditioning to provide information about how CBD affects the acquisition of forms of memory that vary in the level of cognitive engagement. Our results have important implications which will guide future research, and suggest that caution should be used when taking CBD as a therapeutic to treat PTSD and related anxiety disorders.

3I: A Randomized Trial of Medical Cannabis in Patients with Stage IV Cancers to Assess Impact on Opioid Use and Cancer-Related Symptoms: A Pilot and Feasibility Study
Dylan Zylla, Park Nicollet

Background: Cancer-related pain is very common amongst cancer patients, especially those with advanced disease, and can have a negative impact on quality of life. Given the current opioid epidemic, new and effective methods to alleviate this pain along with other cancer-related symptoms are needed. Medical cannabis has been proposed as a potential method to relieve cancer-related symptoms; however, the use of medical cannabis has been limited due to a lack of rigorous scientific data, concerns from patients and clinicians regarding side effects and legal ramifications, as well as high cost. Further research is needed to determine the efficacy of medical cannabis in cancer patients.

Study Design: Patients with any stage IV cancer requiring opioid medication will be randomized 1:1 to early cannabis (EC) (n=25) versus delayed cannabis (DC) (n=25) at Park Nicollet/HealthPartners cancer clinics in Minnesota. The EC group will be provided with 3 months of medical cannabis at no charge. The DC group will receive usual care (e.g., standard medications of pain, nausea, insomnia) for the first 3 months, and then be provided 3 months of medical cannabis at no charge for the second 3 months. Prior to receiving cannabis, patients must first be certified by a doctor for eligibility to receive medical cannabis before registering with the Minnesota Medical Cannabis Program. All patients in the EC and DC study arms will be required to complete a validated symptom survey every 28 days while in the study. Pain control will be assessed by patient's use of a pain measurement diary in which they assess their level of pain each day (worst and average levels). All pain medication usage will be assessed using a pain medication diary calculating average morphine equivalent dose (MED) over a 7-day period each month. The study began accruing patients in February 2018.

Main objective: We aim to determine how medical cannabis impacts cancer-related pain, opioid use, and symptom management in patients with stage IV cancers. Data obtained in this pilot project will help evaluate the feasibility of a larger scale randomized trial to better understand the use of medical cannabis in managing cancer pain and other cancer-related symptoms.

3I: Comparative Chloroplast Genome Studies of *Cannabis Sativa* Strains
Cassandra Perlick, Colorado State University-Pueblo

To identify genomic differences in *Cannabis sativa* strains and to understand how those differences may affect the overall organism, the chloroplast genome (cpDNA) of *Cannabis sativa* strain Carmagnola (NC_026562) was compared to three other strains, Dagestani (KR779995.1), Yoruba Nigeria (NC_027223.1), and Cheungsam (KR184827.1) along with the European hop, *Humulus lupulus* (NC_028032). The cpDNA of Carmagnola is a circular 153,871 bp chromosome with a GC content of 36.6%. The genome contains a total of 219 genes encoding 29 tRNA, 25 rRNA, 22 photosynthesis-related proteins, and 103 hypothetical proteins. The phylogenetic analysis reveals that four *C. sativa* varieties shows 99% sequence similarities, however the Carmagnola strain shows the least genetic relationship between the *sativa* strains (0.5% difference). The *H. lupulus* had the greatest variance from the four strains (1.5% difference). Most genes were organized in conserved co-linear blocks in all four variants. A few minor sequencing variances (e.g., single nucleotide polymorphism and insertion/deletion) were also observed throughout the genome that are expected to be synonymous mutations. All four strains as well as the European hop encoded 16S ribosomal RNA gene that shared high nucleic and amino acid sequence similarity to presumably homologous genes in extant *Bacillus anthracis* and uncultured viruses. The presence of gene homologs shared among all four *C. sativa* strains and bacteria and viruses are highly suggestive of horizontal gene transfer during the early evolution of the *C. sativa* plants. Overall, the four *C. sativa* strains and *H. lupulus* sequences are 99% identical, with few sequence differences (SNPs/Indels). Further analysis will be completed in order to refine these findings and to determine whether these differences have the ability to effect further studies.

3I: Impact of Medical Cannabis on Patient-Reported Symptoms for Cancer Patients Enrolled in Minnesota's Medical Cannabis Program
Susan Anderson, Minnesota Department of Health Office of Medical Cannabis

Background: More than half of all states have legalized medical cannabis, yet there is very little systematic data collection occurring within state medical cannabis programs to assess patient benefits over time. Minnesota's program routinely collects patient-reported scores for eight symptoms (anxiety, appetite lack, depression, disturbed sleep, fatigue, nausea, pain, and vomiting).

Methods: Cancer patients enrolled in Minnesota's medical cannabis program (n=1,120) rated symptoms at their worst over the last 24 hours on a 0–10 numerical rating scale prior to each medical cannabis purchase—typically monthly. A paired statistical comparison was performed between patients' baseline symptom scores and their average symptom scores during the four months following their first purchase. We also analyzed the proportion of cancer patients achieving a 30% score reduction at any time during their first four months and whether

they maintained that control subsequently for a following four-month period. Self-reported side effects including severity were tallied.

Results: Of physician certifiers, oncologists and primary care clinicians certified the majority of cancer patients in this cohort (46% and 30%, respectively). All symptoms showed a significant decrease in score distributions between baseline and the overall four month period following their first purchase indicating that symptoms had diminished over time (p<0.001 for all symptoms). The symptoms with the greatest reduction in median score (baseline vs. four month average) included anxiety (7 to 4.2), lack of appetite (7 to 4.8), and nausea (6 to 3.8). Proportion of patients who achieved 30% symptom reduction ranged from 27% (fatigue) to 50% (vomiting). A smaller percentage of patients were able to achieve a 30% reduction in symptom intensity and maintain that degree of improvement for at least four additional months (range 11% to 28% across all symptoms). Only 10.5% of the patient cohort reported any side effects within four months of their first medical cannabis purchase, and over 90% of these reports were rated as mild or moderate. Top three side effects reported were drowsiness/somnolence/sedation (24%), dry mouth (21%), and fatigue (18%).

Conclusion: Systematic data collection through Minnesota's medical cannabis program suggests that cancer patients are experiencing symptom improvements within a few months of program participation, with some attaining clinically meaningful and lasting levels of improvement. Side effects appeared infrequently and were generally mild or moderate in severity.

3J: The Environmental Consequences of Cannabis Policy
Tony Silvaggio, Humboldt State University Institute for Interdisciplinary Marijuana Research

This panel brings together policymakers, grassroots environmental organizations, and cannabis scholars to provide perspective on important issues often left out of the mainstream discussion and political analysis of the emerging legal cannabis industry—the environmental impacts. Panelists share their expertise and insights on environmental issues related to the cannabis industry, whether it be climate harming reliance on indoor industrial agriculture, pesticide use that harms fish and wildlife, or forest degradation related to public lands trespass grows, as well as the opportunities and challenges for policy makers and researchers attempting to understand and address the environmental impacts of legalization.

4B: Educating in the Gap: A Novel Approach to Harnessing the Subtle Energy of the Endocannabinoid System to Create Multidimensional Climates of Healing with Human Biocrystals in Population-Focused Public Health
Courtney Allen-Gentry, Center for Integrative Nursing and Cannabinoid Sciences

The objective of this presentation is to describe a novel public health theory proposing conscious regulation of the endocannabinoid system to intentionally amplify mental, spiritual and planetary climates of well being through the human biocrystal. An Extracellular Theory of Biological Organisms regards living organisms as biocrystal, a multidimensional composite of crystals arising from an extra cellular crystalline matrix. This crystalline "living matrix" is a continuous fibrous web-work or network of connective tissue that extends into every part of the body. The living matrix is the largest system in the body as it touches all of the other systems.

Regulation of the living matrix, the integrated whole of all bodily systems, is maintained by the parent of all systems, the endocannabinoid system. The endocannabinoid system consists of primary ligands anandamide and 2AG with crystalline receptors, CB1 and CB2, which function to activate intracellular signaling pathways regulating organismic homeostasis at both the micro and macro environmental levels.

Similar to other powerful amplifying mineral crystals, the human biocrystal naturally carries the innate ability to amplify subtle energetic forces. Yet uncommon to other crystals, the human biocrystal has the power to consciously and intentionally use and direct subtle energetic healing forces via the endocannabinoid system. Guarding life's most critical functions, the endocannabinoid system regulates brain activity, cell division, immune response, metabolism and embryogenesis—the proliferation and migration of newly birthed cells. Every time we think a new thought or learn a new behavior, it is due to activation of the endocannabinoid system.

The development of distinctly modern health conditions common to populations with cannabis prohibition are chronic multi-system dysfunctions which are difficult to diagnose and cost billions of public health dollars. Parkinson's, Celiac's, MS, PTSD, anxiety and epilepsy are seemingly unrelated conditions, yet all are related to a dysfunctional or overstressed endocannabinoid system, a condition called Clinical Endocannabinoid Deficiency Syndrome. The experience of health for individuals suffering from these diseases is often complicated by concurrent psychological distress, strong emotions, and frustration with conventional therapies resulting from extensive and expensive diagnostic workups. Significant iatrogenic complication rates are also seen due to unknown etiology of disease. Due to the failure of allopathic providers to resolve these issues, this population often seeks complementary and alternative medicine, and now with some form of legal cannabis in 42 states, they represent a rapidly growing and quite vulnerable tertiary prevention public health population.

This presentation will describe the human biocrystal, discuss its relationship to the endocannabinoid system and identify a theoretical model for the ethical integration of phytocannabinoids into population focused, holistic public health nursing practice. Participants will be guided through multidimensional energetic healing practices which demonstrate through direct experience how to cultivate a healthy endocannabinoid system and intentionally tune the human biocrystal to create localized climates of well being.

4B: Cannabis: Spirit, Mind, Body; What Have We Learned?
Michael Scott, Project PC

For more than a decade I fought for my life. At the peak of my illnesses, I was suffering from an enlarged heart, high blood pressure, morbid obesity (I weighed nearly 400 pounds), sleep apnea, narcolepsy, and several other issues leading to a cancer scare. Following doctors' orders, I went through two operations. The last of which five places in my throat had been removed. After watching friends and family pass away from similar health issues I searched for other ways to heal myself and I found plant medicines. Literally, cannabis saved my life! Dismayed that such plant medicines were illegal or restricted was too much for me to bear. My path became clear. It was time for the truth to be told. I sought out to create positive change. As soon as I was well enough, I grabbed a camera and started documenting the legalization, regulation, and the removal of medical cannabis in Washington state. I've shot hundreds of hours about cannabis and other plant medicines,

traveling all over interviewing and documenting doctors, scientist, researchers, patients, and our politics system. All this work has led to me traveling nationally and internationally sharing what I've learned.

Before my illness, I never followed nor cared too much about politics, but after I was well I knew changes needed to occur. When I asked those in the cannabis community how I could help, well, careful what you ask for, they said, "You should run for office." I ended up joining the Libertarian Party and ran for State Legislative House of Representative in Washington State, twice. I've now spent several years grassroot lobbying for human rights focused on cannabis rights. The documentation and political work I have done over the last five years led to establish a nonprofit named Project Positive Change. Project PC was conceived to create videos and document what was unfolding with cannabis. Its mission grew into much more. Project PC is working on uniting nonprofits with complementary goals and creating mentoring centers to help youth and young adults in our communities.

The journey gave me a unique opportunity to observe and learn from so many folks over the last several years. Watching these people change and seeing new information come to light about this amazing plant has been truly inspiring. Join me as I share the knowledge that I have acquired. My presentation will include short segments from amazing cannabis presenters such as Brian Two Feathers, Dakota's Nation spiritual leader, Dr. Mechoulam, Dr. Makriyannis, Dr. Hart, Dr. Sue Sisley, Kevin McKernan, Dr. Sunil Aggarwal, Dr. Ethan Russo, and a few other amazing stories of how cannabis has changed and saved lives. Cannabis is truly a wondrous plant that can help us with our mind, body, and spirit. Much of the video I've captured no one has ever seen and I am very excited to share the stories and the important information I've captured to help create the positive change we wish to see in this world.

4B: The Spectrum and Prevalence of Reactions to Marijuana in a Colorado Allergy Practice

William S. Silvers, University of Colorado School of Medicine, *Tiana M. Bernard*

Introduction: Since the legalization of medical marijuana and recreational marijuana in certain states, an increasing number of allergic patients are presenting due to marijuana exposure. The majority have significant exposure in the grow industry or are heavy consumers, indicating that cannabis is a mild allergen.

Methods: A voluntary questionnaire addressing our patients' exposures to marijuana, active or passive, and types of reactions was administered.

Results: 134 questionnaires were handed out to patients, 132 answered, and 2 declined. 28 patients experienced symptoms (21%). Of 70 patients who had never used marijuana (53%), 8 had symptoms from passive exposure (12%). Of 37 patients who had used marijuana in the past (28%), 12 had experienced symptoms (32%). Of 17 patients who actively use marijuana (13%), 8 experienced symptoms (47%). Of those who had used marijuana, 28 used a cigarette/pipe (52%), 14 used an oral form (26%), and 11 used a vaporizer (20%). 12 patients exhibited asthma/shortness of breath/cough (43%), followed by 6 with skin/rash/hives (21%), and the remaining 10 (>14% each) reported itchy/red eyes, headache, dry mouth, nausea, and unspecified. Out of 9 patients who had used topical CBD (7%), only 1 experienced reactions (11%). 3 patients work in marijuana production/distribution, but showed no significant difference in reactivity.

Conclusions: Although cannabis itself may be a mild allergen for most, increased exposure, and especially active use, results in increased adverse effects in the allergic population. Other factors involved in the changing production techniques of dispensed marijuana need to be considered in unusual presentations.

4C: Using Microbial Biostimulants to Enhance Productivity? Promise, Possibilities and Challenges

Colin Bell, Growcentia, Inc

In nature, plants interact with tens of thousands of soil microbial species to maximize benefits of nutrient cycling activities within the plant rhizosphere. However, in commercial cultivation practices, it is impossible for managers to provide the microbial functional diversity found in nature in order to maximize plant productivity. As research scientists from Colorado State University, we set out to solve this problem. We have created a platform technology that enables us to optimally select synergistic microbial consortia to maximize nutrient cycling and plant nutrient uptake. Our platform also allows us to select microbial consortia that are compatible and work well in agricultural management practices as well as solving efficacy and shelf life challenges which historically hinder microbial biostimulant effectiveness.

Our impact is developing compatible microbial solutions for real world agriculture challenges. For example, we found one problem that producers face is that when Phosphorus fertilizers are added to soils and other growth media, up to 70% becomes almost immediately unavailable to plants due to natural soil mineral interactions. The microbes in our first technology were selected to unlock bound nutrients, transforming P and micronutrients back into plant available forms, maximizing plant nutrient use efficiency to significantly increase plant yield across many management practices, including: open field row crops, greenhouses, vertical farming and hydroponic systems.

4C: Spectral Control of Vegetative Growth in Cannabis

James Parco, Colorado College, and *Matt Wheatley*, University of Cannabis Technology

With the continued expansion of commercially-grown cannabis within indoor agricultural facilities, a primary concern is the amount of energy that will be consumed when such practices are deployed nationally. Some experts estimate that if high-intensity lighting technologies are employed (metal halide and high-pressure sodium as two examples), cannabis cultivation could account for up to 1% of the nation's energy supply. Thus, it is imperative for indoor cultivators to look to advanced lighting technologies that balance energy use with agricultural objectives such as yield, potency and product quality. This study is among the first to evaluate the amount of light intensity using advanced artificial lighting technologies that alter both the spectrum and intensity on vegetative growth.

4C: New Technology for the Cannabis Circular Economy: Recycling Waste Stalks and Stems into Fiber

Adin Alai, 9Fiber, Inc, and *David Bush*

Jumpstarting the industrial hemp fiber industry using fiber derived from cannabis waste stalks and stems had been deemed a fantasy. However, new, patented, efficient and eco-friendly technology from 9Fiber, Inc and a legislative push to amend Rule 307 will change how we create a circular economy from cannabis trash to feed the fiber industry. Recycling cannabis waste stalk and stems into fiber turns

fantasy into reality and will generate new jobs and new industry in Colorado and beyond.

4D: Worker Health and Safety in the Cannabis Industry
Roberta Smith, Colorado Department of Public Health and Environment

Background: In 2014, the use of recreational marijuana was legalized in the state of Colorado. Prior to this legalization, medical marijuana had been legalized in the November 2000 election. The legalization of recreational marijuana started a new industry in Colorado involving the cultivation and selling of an agricultural product that is not recognized as a legal agricultural product at a federal level. The emergence of a new industry-led occupational health and safety professionals to find ways in which they could begin understand what health and safety risks might exist for employees in the marijuana cultivation business. Currently, there are not many studies that describe these risks that have been published. It was also recognized that employers themselves may not be aware of the OSHA and other regulations needed to make sure their employees were protected on the job.

Methods: The Colorado Department of Public Health and Environment and its partners recognized that employers and employees in this new industry may not understand how to develop and implement a worker safety and health program. A multi-disciplinary group of industrial hygienists and safety professionals was formed to understand the potential risks within the industry. The goal was to develop a comprehensive guide to help those employers within marijuana industry build an industrial safety program that follows best safety and health practices outlining OSHA and other federal requirements. State-specific regulations such as fire safety and pesticide were also included in the document resource. In 2017, a series of two trainings were held to discuss in depth the OSHA regulations and best practices highlighted in the guide.

Results: The result of the collaboration was the publishing of a health and safety guide accessible to the marijuana industry. This document is the foundation of health and safety training programs for the marijuana industry in the state and a model of practice for other states that are facing this new industry. Although this guide is directly focused on the potential hazards in the marijuana industry, the collaborative process used and the resulting guide can be used as a model of outreach to emerging industries.

Conclusions: The legalization of recreational marijuana developed a new large-scale industry in Colorado where occupational health risks had not been previously addressed. Developing a best practice guide for occupational health and safety through industry and subject matter expert collaboration can help new industries understand what is needed to build a culture of safety in their workplace.

4E: Cannabis and Schools: Student Use, Restorative Justice and Source of Revenue
Tim Peters, Colorado State University-Pueblo, *Lynn Knight,* Colorado State University-Pueblo, *Margie Massey,* Colorado State University-Pueblo, *Jenny Piazza,* Colorado State University-Pueblo, *Pam Richmond,* and *Ron Wiley*

A panel discussion highlights key activities and findings from the second year of the K-12 Cannabis Research Study. This study falls into four main categories. 1) Impact of recreational cannabis dispensaries on student use and perceptions towards cannabis: a comparison be-tween students in communities that permit recreational dispensaries and students in communities that do not. 2) Cannabis, trauma and LGBT adolescents: a review of the literature and plan of study to conduct local interviews, focus groups and develop case studies to further explain the high rates of drug use, including cannabis, among lesbian, gay, bisexual and transsexual (LGBT) adolescents. Increased illicit drug use among LGBT youth is often reported as related to traumatic experiences connected to sexual minority identity. 3) Restorative justice practices in Pueblo schools: a review of restorative justice practices implemented this year in local schools, training activities, community outreach and stakeholders' meetings. 4) Cannabis generated school funding: a study of the impact of cannabis tax revenue on education funding.

4F: Lifers Madness: The Movie
Jeffrey Eichen, Rawmaste Productions & Goods

"Lifers madness" is a six part documentary series that focuses on people currently serving life without parole in the American justice system for cannabis. We have added non-violent War On Drugs prisoners to our documentary!

Episode one focuses on prisoners that have served unusually long criminal sentences "Three Strikes You're in" for cannabis-related crimes, and interviews with industry advocates/leaders in the cannabis community that have strong beliefs to releasing people that are serving time in prison for Plant-related crimes, which must end. "Lifers Madness The Movie" interviews Jeff Mizanskey inside the Missouri State Correctional Center. Jeff Mizanskey was a victim of the War On Drugs/ Three- Strike Policy, which kept him from freedom and behind bars for 21 years and 9 months. Jeff Mizanskey is free now as of Sept 01, 2015. Thank you Governor Nixon for Jeff's commutation.

We call them "Plant Prisoners." The goal of the project is to raise awareness and aid in freeing all Non-violent prisoners in America. "Almost 60% of federal prisoners are behind bars for drug offenses: only about 3% are for violent offenses" according to Mikki Norris, Chris Conrad, and Virginia Resner in the book titled Human Rights US Drug War.

Jeff Eichen has spent the last 30 years pursuing the legalization of cannabis. He has spoken with several leaders in the industry across the United States. His background in photography has let him capture this story in a moment by moment cinematic form and now his goal is to push for the creation of a six-part documentary series that would be distributed via broadcast television or online through companies such as Netflix or Hulu. Jeff often quotes Jack Herer: "Hemp-Hemp-Hooray" !!!

"Through film I will dedicate my life to the truth about cannabis and freeing every last Plant Prisoner."

4G: Utilization of Medical Cannabis among Persons Living with Chronic Conditions in Illinois: Self-Reported Symptomology, Preferred Ingestion Methods, and Frequency of Use
Douglas Bruce, DePaul University

Background: Medical cannabis became legal for the treatment of a range of chronic conditions in Illinois in January 2015, and dispensaries began selling medical cannabis products in early 2016. To date, no data linking symptomology to methods of ingestion and frequency of use has been reported among persons using cannabis in Illinois.

Methods: We conducted an online survey of persons with a state

medical marijuana card in Illinois (N=367). Participants were recruited from licensed dispensaries across the state. We summarized respondents' symptoms treated with cannabis, preferred method of ingestion, frequency of cannabis use, and hours spent intoxicated per day. We analyzed differences in ingestion method, frequency of use, and intoxication by number and combination of symptoms (e.g., pain, anxiety, insomnia).

Results: Most commonly reported symptoms treated by cannabis were pain (74.9%), anxiety (65.7%), inflammation (58.8%), and insomnia (56.4%), and a large majority reported multiple symptoms (92.4%). Smoked flower only (44.2%) and combinations of methods (33.1%) were most preferred ingestion methods across the sample. Preferred ingestion method did not differ significantly as number of symptoms increased. While frequency of use increased significantly with number of symptoms (F=6.12, p<.01), hours typically intoxicated per day did not significantly increase with number of symptoms or higher frequency of use.

Discussion: Participants in this sample treated a constellation of symptoms with medical cannabis. While frequency of use increased with number of symptoms experienced, number of hours intoxicated did not increase correspondingly, suggesting that patients experiencing multiple symptoms may be selecting less psychoactive cannabis products. Future research may benefit from more granular examination of types of compounds within cannabis products to better understand utilization trends among cannabis patients who experience a range of symptomology associated with chronic conditions.

4G: Including PTSD in Colorado: The Intersection Between Research, Politics and Public Opinion in Medicinal Cannabis Policy
Teri Robnett, Cannabis Patients Alliance

Although medical marijuana was approved by Colorado voters in 2000, it wasn't until 2017 that the first condition, post-traumatic stress disorder (PTSD), was added to the original eight. The years-long effort by patients and supporters included four petitions, two bills and a lawsuit. Why did it take so long, and how did research, politics, and public opinion influence the process?

4G: The Jack Splitt Memorial Marijuana Resource Bank
Omar Estrada, Colorado Department of Education

The Jack Split Memorial Marijuana Resource Bank was signed into law in June of 2017. The bill directs the Colorado Department of Education to create and maintain a resource bank for public schools to use without charge that consists of evidence-based, research-based, and promising materials and curricula pertaining to marijuana use. This first of its kind resource bank gives schools in Colorado the tools necessary to help address the issue of marijuana in the age of recreational use. In addition to input from both outside and inside the marijuana industry, users of the bank are also provided with a feedback section to the bank where any educator can vocalize their suggested improvements. The goal is to provide useful resources that keeps the whole child in mind to all schools in Colorado while ensuring consistent updates as new promising practices and programs arrive.

4H: Cannabis, Pregnancy, Breastfeeding, and Motherhood
Jeanna Hoch, CannaMama Clinic

Parents face the ultimate punishment for their cannabis consump-

tion: removal of their children from their custody. Mothers who choose to medicate with cannabis while pregnant and breastfeeding, known as "cannamamas," also face a loss of bodily autonomy and ability to improve or maintain their health with cannabis. The lack of research and public knowledge on children born to cannamamas harms those women, their children, and their families. Women are allowed to consume medications with known negative side effects to the developing offspring without fear of legal ramification as an important right to bodily autonomy. Cannamamas choose cannabis as a safer alternative to pharmaceutical and over the counter medications. They also have the same right to bodily autonomy, and to make the medical decision they feel is best for themselves and their children. However, stigma, discrimination, and government intrusion prevent these women from free choice to medicate with cannabis. It is important to examine the challenges cannamamas face with very little evidence the fetus or nursling is harmed by her medical decision. My company, CannaMama Clinic, consults with and coaches cannamamas, and conducts research on our members and their babies with surveys. Their family's lives get turned upside down at the government's whim. Their right to privacy was violated with unjust investigation and intrusion into their lives. The cannabis community and conference attendees need to know this sexist problem exists.

5B: Δ-Tetrahydrocannabinol and Cannabidiol Treatment of Inflammatory Pain in Rats
Rebecca Craft, Washington State University

Phytocannabinoids may be effective treatments for inflammatory pain because they can decrease nociceptive transmission as well as decrease immune activation that contributes to inflammation. The purpose of this study is to compare the effects of two phytocannabinoids, Δ9-tetrahydrocannabinol (THC) and cannabidiol (CBD) on antinociception and edema using a model of persistent inflammatory pain in male and female rats. After baseline measurements on day 1, inflammation and pain was induced by intraplantar injection of complete Freund's adjuvant (CFA). One h post-CFA, vehicle, THC (1.0, 2.0, or 4.0 mg/kg) or CBD (1.25, 2.5, or 5.0 mg/kg) was administered i.p. The same treatments were administered again at 1700 on Day 1, and at 0800 and 1700 on Days 2 and 3. At 0800 on Day 4, rats that had previously received vehicle were injected with either vehicle again, or an acute dose of THC (1.0, 2.0, or 4.0 mg/kg) or CBD (1.25, 2.5, or 5.0 mg/kg), and rats that had previously received a cannabinoid were injected with the same dose of the same cannabinoid. Mechanical allodynia, heat hyperalgesia, biased weight-bearing and locomotor activity were assessed at 30, 60, 120 and 240 min post-injection, and edema was assessed at 240 min. THC dose-dependently reduced mechanical allodynia, thermal hyperalgesia, and locomotor activity in both males and females when measured on Day 4, but had significantly greater anti-allodynic and anti-hyperalgesic effects in females than in males. Rats that had been treated with THC for three days before the Day 4 test were tolerant to THC's heat analgesic and locomotor suppressant effects, but not to THC's anti-allodynic or anti-hyperalgesic effects. Rats treated with THC chronically (but not acutely) also increased weight-bearing on the inflamed paw, and THC decreased paw edema approximately 20% (more so in males than females). Similar to THC, CBD significantly reduced mechanical allodynia and thermal hyperalgesia, and tolerance developed to CBD's heat analgesic effect but not to its anti-allodynic and anti-hyperalgesic effects. In contrast to THC,

CBD did not alter locomotor activity, weight-bearing on the inflamed paw, or hindpaw edema, and there were no sex differences in drug effects. The present results suggest that both THC and CBD may provide some relief from inflammatory pain. Additionally, tolerance appears to develop more readily to THC's sedative effect than to its pain-relieving effects, suggesting that (unlike opioids), the therapeutic window for cannabinoid analgesia may not decrease with repeated use.

5B: Opioids and Marijuana in the Management of Pain: Is There a Relationship?
Kenneth Finn, Springs Rehabilitation, PC

Marijuana and opioids are commonly used to treat pain. The medical literature for the use of marijuana in pain is unclear although the current scientific evidence does support potential benefit in a variety of conditions. There is conflicting data as to whether medical marijuana laws are associated with lower opioid use and opioid overdose deaths. This presentation will outline the basic science of the endocannabinoid system and the medical literature as it relates to use in pain and how this may or may not impact the opioid epidemic.

5B: Perceived Acute Effects of Cannabis on Negative Affect
Carrie Cuttler, Washington State University

Cannabis is commonly used to treat symptoms of depression, anxiety, and stress. However, few studies have examined the effects of cannabis—or its constituents—on symptoms of negative affect, and most have used oral methods of administration. This study was conducted to provide a naturalistic account of patients' perceived changes in symptoms of depression, anxiety, and stress, as a function of inhaling different strains and doses of cannabis. Data from the app Strainprint™ were obtained and analyzed. Using this app, patients indicated the symptom they were experiencing, rated its severity, entered information about the cannabis they were about to use, and then re-rated their symptom 20 minutes after cannabis use. In total 11,953 sessions were analyzed using multilevel modeling (3,151 for depression, 5,085 for anxiety, and 3,717 for stress). Patients perceived a 50% reduction in depression and a 58% reduction in anxiety and stress following cannabis use. Low doses (two puffs) were sufficient to reduce ratings of depression and anxiety, while higher doses (10+ puffs) produced the greatest reductions in stress. High CBD/low THC strains were associated with the largest changes in depression ratings, while high CBD/high THC strains produced the largest perceived changes in stress. Examinations of tracked sessions across time revealed no changes in the perceived efficacy of cannabis. However, baseline symptoms of depression (but not anxiety or stress) were exacerbated across time/tracked sessions. The results indicate that cannabis reduces perceived symptoms of negative affect in the short-term, but continued use may exacerbate symptoms of depression over time.

5C: Dosing and Microdosing Medical Cannabis: Why, Who and How
Jordan Tishler, InhaleMD

Medical marijuana patients are increasingly realizing the value of proper dosing or even microdosing, which offers patients more control over their medicine and can help them decrease unwanted side effects. However, most lay-oriented educational approaches focus on doses that are either "seat of the pants" or just simply too large. Both available products and the education that goes with them need to change to facilitate proper care of patients.

In this session, Jordan Tishler MD will provide an in-depth look at both dosing and microdosing and offer insight on why and how to address proper dosing with patients. You'll get insights on:
- What is the difference between dosing and microdosing and how each benefits patients
- The ideal types of products to use for dosing and microdosing
- Bioavailability and how it affects proper dosing, microdosing, and proper product selection
- Special considerations from science and food manufacturing that aren't often associated with conventional medications.

5C: "I Ate How Much?!" User Experiences with Cannabis Edibles
Josh Meisel, Humboldt State University, *Sue Sisley*, Scottsdale Research Institute, and *Jane Fraser*, Colorado State University-Pueblo

Cannabis is the most widely used illicit substance in the United States and liberalization of state cannabis laws has been associated with greater usage, refined cultivation methods, increased THC potency, and diverse modes of ingestion. Taken together these shifts create challenges and opportunities for public health professionals. Inadequate product labeling and inconsistent dosage control during manufacturing resulted in a spike of reported cannabis overdoses shortly after some U.S. cannabis markets became legal in 2014. Such episodes have more commonly been associated with edible use. This study examined user experiences with edibles in order to identify factors contributing to the onset of a negative edible experience, coping strategies reported, and the influence of such experiences on subsequent cannabis or edible use. Open-ended in-depth interviews were conducted with a nonrandom sample of medical and recreational cannabis users in California and Colorado. Interviewees were asked to describe their prior cannabis experience with cannabis and introduction to cannabis edibles as well as share the story of their negative edible experience. Interview transcripts were analyzed for emergent themes and lessons for product labeling and public health campaigns are discussed.

5C: Budtender Horror Stories
Evan Hundhausen, Author, Freelance Writer, Freelance Journalist

Ever wonder what a budtender goes through at dispensaries in Colorado? Evan Hundhausen got the skinny and shares budtender stories he recorded anonymously from people working in the industry. Inspired by "Bartender Horror Stories" (you may have seen these types of blog posts online), the article was published in a Denver cannabis magazine. Not just horror stories were uncovered, but love stories and even comedic ones as well.

5E: The Highs and Lows of Collegiate Cannabis Prevention Efforts: Lessons Learned from an Adult Use State
Laurie Jevons, NASPA, and *Mallory Jordan*

In 2015, the Coalition of Colorado Campus Alcohol and Drug Educators (CADE) was awarded funding through the Colorado Office of Behavioral Health to reduce harms among the collegiate population associated with alcohol, cannabis, and other drug abuse. Each academic year, CADE project staff select six to nine campuses each year to implement or improve on programs and processes supported by research (e.g., SAMHSA NREPP) or holding promise for adap-

tation within the collegiate environment (i.e., promising practices). These campuses include two-year and four-year campuses, private and public campuses, rural and urban campuses, at a variety of sizes and resource levels.

In this session, CADE project staff will highlight strategies from four institutions of higher education (Fort Lewis College, Durango, CO; Regis University, Denver, CO; Adams State University, Alamosa, CO; and Western State Colorado University, Gunnison, CO) to showcase how prevention teams are addressing cannabis use on campus. 30 percent of college attending youth in the state of Colorado report consuming cannabis in the past 30 days. Resources dedicated to high risk cannabis use and education are inconsistent between institutions of higher education.

In addition, 11 campuses shared their data from the American College Health Association-National College Health Assessment (ACHA-NCHA) to support the creation of a statewide data set. Preliminary data regarding cannabis use from this data set will be shared in comparison to the national data.

5G: Relationships among Cultivars, Leisure Interests and Leisure Motivations in a Sample of Young Adult Cannabis Consumers
James Gould, University of Northern Colorado, and *Richard Donnelly*

The purpose of this study was to explore the cannabis consumption preferences, leisure interests, and leisure motivations of recreational cannabis consumers. Participants ranged from ages 18 to 56 with a mean age of 21.9 years and 54.2% were men and 45.8% women. Descriptive statistics were used to observe differences between men and women in their methods and preferences for cannabis consumption. Frequencies were assessed to determine the proportions of respondents and their top ranked leisure interest by the four categories of cultivar (sativa, indica, hybrid, and unsure). A multiple regression analysis was conducted to determine which of the four factors of the Leisure Motivation Scale best predicted the strength of the preferred psychoactive effect and times per week they consumed. An ANOVA was used to test for differences among the four factors of the LMS as dependent variables across the independent variables of preferred leisure interests (5 categories). For the type of cultivar $\chi(3)=19.5$, p=.000, a significantly higher proportion of men preferred sativa than women. Women indicated a greater preference $\chi(4)=19.1$, p=.001, for consuming edibles than males. Social activity (time with friends, developing relationships) was the most highly ranked (37.2%) interest for all strains. Outdoor activity (fresh air, nature, outdoor environment) (16.5%) and Musical activity (live music shows, playing music) (16.0%) pursuits were the second and third highest ranked interests. Stimulus avoidance was the LMS factor that most significantly contributed to predicting preferred psychoactive effect (b=.215, p=.000), followed by competence-mastery (b=.155, p=.015). Competence-mastery best predicted the number of times per week (b=.275, p=.000) the respondents consumed, followed by social motivations (b=.151, p=.016). There was a significant difference among leisure interests groups in LMS scores F(16, 996)=2.76, p=.000 and the Tukey post hoc test revealed differences in social motivations (F(4, 329)=2.66, p=.033) and competence-mastery motivations (F(4, 329)=2.76, p=.002). The social (M=3.26) and musical (M=3.14) leisure interest groups reported greater social motivation scores than did the electronics (M=2.58) group. For competence-mastery motivation, the social (M=2.86) and

artistic (M=3.3) groups demonstrated greater motivation than the Electronics group (M=2.31). These findings will be discussed in relation to consumer experiences of the growing number of cannabis friendly leisure and hospitality services provided in Colorado.

5G: Cannabis Use Patterns and Healthcare Encounters in Colorado
Daniel Vigil, Colorado Department of Public Health and Environment

The Marijuana Health Monitoring and Research Program at the Colorado Department of Public Health and Environment analyzes population surveys, poison center data and hospital data to monitor trends in cannabis use and healthcare encounters with a mention of marijuana. This presentation will cover use over time among adolescents and adults, plus breakdowns by age, gender, race/ethnicity and use among pregnant women. Comparisons will be made with alcohol and tobacco use. The presentation will cover poison center calls, emergency department visits and hospitalizations with mention of marijuana over time for all ages. Limitations and reasonable conclusions will also be covered, as well as a summary of multi-state and national efforts to improve monitoring of these types of data.

5G: Cannabis: Retina, Brain and Functional Impairment
Denise A Valenti, IMMAD

Our work fits into panel or paper sessions specific to marijuana impaired driving. Our review work also can be included in discussions of chronic, early onset use and brain changes.

Cannabinoid receptors are throughout the eye retina. Cannabis depletes retinal dopamine. Retinal amacrine cells are involved in processing acetylcholine and cannabinoids disrupt this neuroprocessing in the retina. Disruptions in neurotransmitter balance due to disease, medications or drugs such as cannabis can result in dysfunction in the retinal ganglion cells (RGCs). Chronic cannabis use, as well as acute use causes dysfunction in the RGCs. Although not our work, this was reported in the *Journal of the American Medical Association* in 2016. Our work using functional tests of retina have demonstrated such losses in humans. Also, not our work, animal studies have shown losses upstream in major vision nuclei and the vision processing regions of the brain. That there are disruptions in visual function is further demonstrated in humans with brain imaging. The retina is window to neural structure and functioning as the axonal layers and cells can be visualized and imaged noninvasively in humans and animals. Precise retina functions other than just simple acuity can be measured. We have case study data demonstrating how retinal functioning can be used as a marker for functional impairment to drive with the use of marijuana. (Our larger data set is to be part of a research conference abstract in May.)

5H: An Experimental Investigation of Cannabis Policy Environments on Cannabis Use Attitudes, Norms, Beliefs, and Intentions among Young Adults
Alyssa Rudy, Virginia Commonwealth University

Introduction: Despite little change in federal cannabis restrictions in the US, many states (e.g., Colorado and Arizona) have legalized cannabis for recreational and/or medicinal use. Research is needed to examine how such policies may influence cannabis use, particularly among a group at high risk for use—young adults.

Methods: In 2017, 446 young adults (M age = 20 years) in a US state where cannabis is illegal (recreational/medical) participated in an online survey including demographics, cannabis use patterns, and baseline cannabis use intentions, followed by randomization to one of three hypothetical cannabis policy environments (legal policy, medical policy, illegal policy) where environment-specific scenarios were presented (e.g., Imagine living in a state where cannabis use is illegal...). Within the environment context, participants completed measures regarding cannabis use attitudes, norms, perceived behavioral control, self-efficacy, and intentions. Bivariate analyses, ANCOVAs, and post-hoc comparisons were conducted.

Results: Controlling for school year, grades, past 30-day cannabis use, and baseline cannabis intentions, ANCOVAs revealed a significant effect of policy environment for cannabis attitudes, norms, self-efficacy, and use intentions. Post-hoc comparisons revealed exposure to the legal-policy and medical-policy environments resulted in higher mean cannabis attitudes (more favorable), self-efficacy, and post-randomization use intentions compared to the illegal-policy environment.

Conclusion: These findings suggest that even when controlling for baseline cannabis behavior/intentions, fewer cannabis restrictions were associated with more favorable attitudes toward cannabis and higher self-efficacy and intentions to use cannabis. Future research should examine the relationship between intentions to use and actual cannabis use prior to and following policy changes.

5H: Gender Differences in Patterns of Marijuana Use Over Time in the 55-64 Year Old Population
Kasia O'Connell, Westat, and *Jessica Taylor*

Americans 55 to 64 years old are the fastest growing segment of marijuana users. Although marijuana use has increased among all age groups, use by 55 to 64 year olds increased by 455%, from 1.1% in 2002 to 6.1% in 2014. In comparison, use by 26 to 34 year olds increased by 65%, from 17.3% to 19.6%, during this same timeframe. Factors that have contributed to increased marijuana use in the 55–64 age group include changes in state marijuana laws and local policies, increased use of marijuana as an alternative treatment for health related problems, greater social acceptance of marijuana, and the continued use by lifetime marijuana users as they age into the age group. Information regarding the patterns and correlates of use among this age group may be useful to researchers, practitioners and policy makers responsible for designing outreach, and prevention and treatment programs. Little is known about the role played by, for example, gender, age of onset of use, geographical region, race, or socioeconomic factors such as education and employment status in the use of marijuana and the development of marijuana use disorders among 55–64 year olds. In this study, we use National Survey on Drug Use and Health (NSDUH) data (2002–2015) to examine the gender differences in marijuana use over time in the 55–64 year old age group. Among this population, we examine the age of when marijuana was first used by gender, identify patterns of marijuana use over time, and the development of marijuana use disorder within the past year.

5H: Evidence of a Link Between Obsessive-Compulsive Disorder and Cannabis Misuse
Dakota Mauzay, Washington State University

A wealth of research has linked cannabis use to a variety of psychological disorders including depression, anxiety, psychosis, and post-traumatic stress disorder. In contrast, there is a paucity of research investigating the link between cannabis use and obsessive-compulsive disorder (OCD). As such, the purpose of the present study was to explore associations between severity of OCD symptoms, cannabis use, and cannabis misuse. We further sought to determine whether cannabis coping motives (i.e., using cannabis to cope with negative affect and other problems) mediate the putative link between OCD and cannabis use/misuse. A total of 430 young adult cannabis users completed an online survey containing measures of OCD symptoms, cannabis use, cannabis misuse, and cannabis use motives. The results indicated that severity of OCD was unrelated to frequency and quantity of cannabis use, but it was significantly, positively related to increased cannabis misuse (i.e., problematic cannabis use and symptoms of cannabis use disorder). These effects persisted after controlling for anxiety, depression, and stress. Further, coping motives were found to mediate the link between OCD symptoms and cannabis misuse. Together, these findings indicate that symptoms of OCD predict increased use of cannabis for the purposes of coping and that these coping motives may increase cannabis misuse. As such, we recommend that individuals with OCD symptoms avoid using cannabis to cope because it may make them more vulnerable to the development of problematic use and cannabis use disorder.

5H: The Entourage Effect: Concerted Teamwork or Chemical Complexity?
Adam Richardson, Aegis Biotech

The phrase "the entourage effect" is often used when discussing the medical effects of cannabis. The meaning varies greatly however, depending upon the context. The first scientific use was by Shimon Ben-Shabat, Raphael Mechoulam and the rest of the team at The Hebrew University in their classic paper "An entourage effect: inactive endogenous fatty acid esters enhance 2-arachidonoyl-glycerol cannabinoid activity" in the *European Journal of Pharmacology*. The study showed the endogenous cannabinoid 2-arachidonoyl-glycerol (2-AG) bound to both CB1 and CB2 more tightly when in the presence of two endogenous fatty acids that do not activate CB1 or CB2 on their own. The increase in receptor response to 2-AG was observed both in cell-based receptor binding assays and in standard in vivo mouse models of cannabinoid receptor activity.

So in terms of molecular pharmacology, the entourage effect is the idea that lipids somehow alter the interaction between the (endo) cannabinoids and the cannabinoid receptors without having any independent activity. This is where the definition of the entourage effect becomes more complicated. The biochemical model of the entourage effect strongly suggests that a ""carrier lipid" (such as terpenes) would increase the potency of any cannabinoid. Considering there are over 100 terpene and cannabinoid compounds each in cannabis, in different ratios, the complexity makes the outcomes impossible to fully predict. In addition, many terpenes have medicinal properties of their own. Most of these uses are based upon traditional medicines, whole plant extracts and essential oils with modern research beginning understand some of the mechanisms.

In current usage, the entourage effect generally refers to the synergistic and differentiating effects the various terpene and cannabinoid combinations within cannabis provide. How much of these pharmacological outcomes are due to a lipid carrier effect at the CB1 and CB2 receptors versus what is due to the activation of a multitude of hu-

man receptors remains to be discovered. Interestingly, this brings us back to the original cultivation of cannabis thousands of years ago. As humans selectively bred cannabis for certain ailments—and selected these properties for genetically distinct human populations—we encouraged the development of helpful chemistry without concern for the mechanism of action. So evolutionary it is no surprise that the cannabis pharmacopeia is more effective in combination than as individual compounds for many conditions.

This presentation will review the (surprisingly scant) scientific literature on reports of an "entourage effect," identify assumptions and gaps in our knowledge, and suggest further routes of scientific and medicinal development for cannabis-based therapies.

5H: More Than Just Taste and Smell: Examining the Complexity and Diversity of Terpene Profiles from Popular Cannabis Strains
Andrew Defries, Sangre AgroTech

Cannabis synthesizes a diversity of secondary metabolites. Selection and breeding has resulted in strains with enhanced cannabinoid potency and unique flavor profiles called chemotypes. Volatile organic compounds known as terpenes responsible for the smell and taste of cannabis are becoming recognized as medicinal molecules in their own right. Our goal is to create a botanical classification system to delineate chemotype groups and subgroups in popular strains using terpene profiles. When used in conjunction with genetic data we aim to determine the lineage of unknown strains and to guide future breeding projects to develop specific and unique chemotypes.

5H: Oncology Clinicians and the Minnesota Medical Cannabis Program: A Survey on Medical Cannabis Practice Patterns, Barriers to Enrollment, and Educational Needs
Dylan Zylla, Park Nicollet

Background: Medical cannabis has been available in the state of Minnesota since July 2015 through the Minnesota Medical Cannabis Program (MMCP). Many factors appears to limit the use of medical cannabis in the cancer population, including: (1) the lack of rigorous scientific data demonstrating improvement in symptoms compared with usual care, (2) concerns from patients and clinicians regarding potential side effects, the effect on current oncology treatments, and potential legal ramifications; and (3) the nearly universal lack of insurance coverage for medical cannabis therapies. Our study aimed to delineate oncology providers' views on medical cannabis, identify barriers to patient enrollment and assess clinician interest in a registered clinical trial on medical cannabis in stage IV cancer patients.

Methods: From June 2017 to August 2017, we distributed a 14-item survey to Minnesota oncology physicians as well as advanced practice nurses and physician assistants who care for adults and children with cancer. Descriptive analyses were performed for each question.

Results: One hundred fifty-three of the 529 eligible survey participants (29%) responded to our survey. The majority identified themselves as a medical oncologist or medical oncology nurse practitioner/physician assistant (n=125, 82%), most practiced in a community setting (n=102, 67%), and nearly half (n=68, 44%) had registered with MMCP. Overall, 65% of respondents supported use of medical cannabis. Perceived cost and inadequate research were the highest barriers to MMCP and patient. The lowest barriers included the health group not supporting/allowing certification of patients and risk of social stigma. 36% of all respondents lacked confidence in discussing the risks and benefits of medical cannabis, and 85% wanted more education.

Conclusions: Although there continues to be growing support for cannabis use in the cancer setting, significant barriers remain. This study illustrates a clear need for clinicians to receive both data and education to guide in their discussions about the benefits, risks, and cost considerations of using medical cannabis for cancer-related symptoms.

5I: How Much THC Did You Smoke?
Cristina Sempio, University of Colorado at Denver

Introduction: Cannabis is by far the most widely cultivated, trafficked, and abused illicit drug. Cannabis consumption is generally monitored by the detection of Δ9-tetrahydrocannabinol (THC) and its metabolites, 11-hydroxy-THC (11-OH-THC) and 11-nor-9-carboxy-THC (THCCOOH), in plasma or urine. Recently, the surge of marijuana legalization and the use of other cannabinoids such as cannabidiol (CBD) in preclinical, clinical and observational trials increased the need for sensitive and specific methods to establish dose-effect relationships of THC and other cannabinoids.

Objective: We developed and validated an online extraction high-performance liquid chromatography coupled to tandem mass spectrometry (LC/LC-MS/MS) method for simultaneous quantification of 11 cannabinoids and metabolites including THC, 11-OH-THC, THCCOOH, THCCOOH glucuronide (THCCOOH-gluc) in human plasma and urine. Furthermore, we created a population pharmacokinetic (PK) model for THC and three major metabolites including population variability to obtain a better and more precise estimate of THC consumption to complement the traditional questionnaire.

Methods: Human plasma or urine were spiked with the appropriated concentrations of cannabinoids and 200 μL was extracted using a simple one-step protein precipitation procedure. The extracts were analyzed using LC-APCI-MS/MS in combination with online extraction. The mass spectrometer was run in the multiple reaction monitoring (MRM) mode. For the population PK model, phase 1-type data were simulated based on previously published data using the software Phoenix 64® - NMLE 7.0 by Certara while phase 3-type data (sparse data) were obtain using the validated LC-MS/MS analytical assay. The phase 1-type data and phase 3-type data were combined to create the population PK model.

Results: The analytical assay was validated according to FDA guidelines. To date, 1260 plasma and 247 urine samples collected during clinical and observational studies in marijuana product users were analyzed with our assay. Sixty-seven subjects enrolled in a CDPHE observational study were selected as sparse data and combined with the simulated phase 1-type data. Using the developed population PK model, THC consumption estimation were back-extrapolated and compared with the consumption declared on the self-reported questionnaire. A coefficient of determination of $R^2 = 0.322$ was obtained (p<0.01).

Conclusion: We present a validated, high-throughput, sensitive and specific method for quantification of eleven cannabinoids that can be used for clinical monitoring and research studies. Furthermore, we present a population PK model that improved sparse data interpretation and allow a more precise and objective estimate of THC consumption based on a single sample analyzed with said assay. The com-

bination of these two techniques may be a cost effective and reliable complement for self-reported questionnaire and will address the gap in establishing dose-response relationships in observational cannabis studies.

5I: Exploring Farmworkers' Safety and Health Issues Working in Cannabis Industry
Farzaneh Khorsandi, University of California, Davis, *Marc B. Schenker*, Western Center for Agricultural Health and Safety, and *Diane Mitchell*, Western Center for Agricultural Health and Safety

Cannabis is the unspoken number one agricultural product in California, with an estimated $23.3 billion in cash farm recipient. About 100,000 farmers and farmworkers work in the cannabis industry in California. Unfortunately, due to the illegal nature of most cannabis production in the California, very little research specifically addresses the health and safety issues of farmworkers in this area.

In California, commercial cannabis producers require a license which will be issued beginning in January 2018. A new bill also requires cannabis producers to train employees in worker safety within one year of receiving their license. The sharp increase in the number of cannabis employees combined with the lack of research and demand for trained workers intensifies the need for an assessment to detect the health and safety hazards of working in this industry and the development of a health and safety outreach program.

The first aim of this project is to conduct an assessment to explore the health and safety issues working in the cannabis industry. The health and safety hazards in cannabis production include biological, chemical, and physical hazards. Among physical hazards, we explore repetitive motion, inserted force, and awkward posture. We also seek to develop an outreach program to educate workers and supervisors about potential hazards and accidents in this field, and appropriate prevention methods and protective equipment.

5I: Novel Genotyping Methods Reveal Large Diversity in Terpenoid Catalytic Sites in *Cannabis Sativa*
Christian Cizek, Steep Hill

Monoterpenoid and sesquiterpenoid compounds are secondary metabolites produced by most plant species. These compounds have an increasingly important role in the realm of medicine, as they are alternatives to opioid based drugs, and serve as carriers for other plant derived medicinal compounds. We have shown that there are numerous terpenoid synthase genes in single strains of *Cannabis sativa*. Each gene is comprised of seven exons allowing catalysis of varying monoterpenes in plastids. These nonpolar terpenes are used as signaling molecules and are transported across membranes, and eventually out of the cell. Catalysis of terpenoid compounds in many species is performed by the DDXXD motif in a terpenoid synthase. In *Cannabis sativa*, the catalytic site was found to be DDIYD. Primers were designed to target this catalytic regions for high resolution melt analysis. In the analysis of the DDIYD motif of TPS4 in *Cannabis sativa*, five different genotypes were discovered, representing a variation in terpene chemical expressions.

5I: A Survey Study of the Health Impact of Cannabinoid Use among Patients with Autism Spectrum Disorders
John Matuszewski, Realm of Caring Foundation

Introduction: Autism is a spectrum of disorders that can impact development in social skills, speech, and nonverbal communication, and that also can be accompanied by repetitive and other abnormal behaviors. There is increasing interest in the therapeutic potential of using cannabinoids to treat autism spectrum disorders. Little systematic data has been collected about the naturalistic use of cannabinoids for autism.

Methods: Patients or adult caregivers registered with the Realm of Caring Foundation, a non-profit focused on education related to the use of hemp products for epilepsy and other health conditions, were invited to participate in a web-based survey study that assessed demographic and health-related outcomes. Participants completed a baseline assessment and analyses were conducted to compare patients using cannabinoids versus those who were not on health-related outcomes using validated assessments. T-tests and Chi-Square tests were used and significance was determined at $p<0.05$.

Results: A total of 51 patients completed the survey; 25 were using cannabinoids and 26 were contemplating initiating use, but had not yet done so. Products high in CBD, versus those high in THC, were predominant among those who had initiated cannabinoid use. Cannabinoid users reported significantly less anxiety, measured using the Hospital Anxiety and Depression Scale (HADS). Children who were using cannabinoids were rated as having significantly better sleep quality by their parent/caregiver as assessed by the Children's Sleep Habits Questionnaire (CSHQ). There were no differences between users and non-users on self-reported quality of life, satisfaction with health, pain, adult sleep, or number of non-cannabinoid medications used, though qualitative trends suggesting improvement among cannabis users was observed for ratings of pain, depression, and health satisfaction compared with non-users.

Conclusions: In a convenience sample of patients with autism spectrum disorders enrolled in an observational research registry, current users of cannabinoids reported qualitatively better outcomes across a number of health-related measures compared with a demographically similar group of patients not using cannabinoids. Data collection is ongoing and will include longitudinal analyses of these patients over time. Initial outcomes in a relatively small sample indicate that a subset of patients respond positively to cannabinoid products high in cannabidiol, and suggest that more controlled research and targeted cannabinoid drug development in the treatment of autism spectrum disorders is warranted.

6A: Smart Product Design through Clinical Data Mining
Raj Gupta, Folium Biosciences

Clinical data was mined from the last 40 years on the combination of (1) CBD and (2) CBD with THC for multiple indications. Experimental and observational studies were included and meta-analysis of studies were emphasized. A novel approach to design a medicinal product for consistent and improved absorption is discussed. A technology platform is defined for future product development allowing inclusion of additional botanical actives with cannabinoids.

6B: Effects of Cannabinoids in Adults with Medically Refractory Epilepsy
Barbara Brett, Colorado State University-Pueblo

Epilepsy is a neurological disorder that affects approximately 50 million people worldwide. Most individuals with epilepsy are treated successfully with one or more anti-epileptic medications, although

numerous, unpleasant side effects are reported. Approximately 30% percent of patients with epilepsy experience medically refractory or treatment-resistant epilepsy. Persistent epileptic seizures have severe consequences for both the patient's health and quality of life. Although cannabis-based therapies have been used to treat seizures for many thousands of years, research is just beginning to be accumulated. Most information available is limited to case studies, small case series, and surveys, reporting on the use of a variety of medicinal cannabis preparations containing a variety of cannabinoids, used as either mono- or adjunctive treatments. An exception is substantial new evidence from two randomized control trials that support the safety and efficacy of cannabidiol (CBD) as a treatment for seizures in two severe forms of childhood epilepsy. Evidence for the effectiveness of cannabis-based treatment in adults with epilepsy is limited. The purpose of this presentation is to provide an update about the PI's ongoing observational research examining the effects of medicinal cannabis use in adults with medically refractory epilepsy.

6B: Open Label, Dose Escalation Study of Cannabidiol in Parkinson's Disease
Maureen Leehey, University of Colorado

Background: The use of cannabidiol (CBD) is increasing in neurological disorders, including Parkinson's disease (PD), as it becomes more available in the US, but there is little data regarding its efficacy, tolerability and the appropriate dosage.

Methods: In this open label, dose-escalation study, participants with PD took an oral pharmaceutical formulation of purified CBD (Epidiolex®, GW Pharmaceuticals), increasing from 5 to 20-25 mg/kg/day, as studied in pediatric epilepsy. The primary outcome was tolerability and safety; secondary outcomes were efficacy in reducing tremor and common PD symptoms. CBD plasma concentrations were evaluated using a previously validated and published high performance liquid chromatography (HPLC) atmospheric pressure chemical ionization (APCI) mass spectrometry (MS) based assay.

Results: Of 13 participants (10 male), mean age (SD) 68.15(6.05), baseline total and motor Movement Disorder Society Unified PD Rating Scale (MDS UPDRS) scores of 39.23 (13.32) and 22.92(9.30), respectively, 13 (100%) reported at least one adverse event, including diarrhea (n=11 [85%]), somnolence (n=9 [69%]), fatigue (n=8 [62%]), weight gain (4 [31%]), dizziness (n=3 [23%]), abdominal pain (n=3[23%]) and headache, weight loss, nausea, anorexia, and increased appetite (each n=2 [15%]). Five participants (38%) had elevated liver enzymes, 2/5 had a cholestatic pattern, 4/5 were asymptomatic, and all were transient. A total of 132 adverse events were observed, 111 (84%) mild, 19 (14%) moderate, and 2 (2%) severe; diarrhea was more frequent at higher doses (p value = 0.0307). There were no serious adverse events. Three (23%) stopped study drug due to intolerance. Ten participants (8 male), age 68.70(6.65) that completed the study, taking an average maximum dose of 20.25 (SD 3.43) mg/kg/day, had improvement in total and motor MDS UPDRS scores of 7.70 (SD 9.39, mean decrease 17.8%, p=0.0115) and 6.10 (SD 6.64, mean decrease 24.7%, p=0.0041), respectively. Tremor scores on the MDS-UPDRS did not change significantly. Assessments of nighttime sleep and emotional behavioral dyscontrol also improved significantly. While some participants reported improvements at low doses, formal efficacy assessments were performed only at baseline and the highest dose achieved. Among the ten subjects that completed the study, one

subject completed the study with a dose of 12.5 mg/kg/day, 7 with a dose of 20 mg/kg/day and 2 with a final dose of 25 mg/kg/day. CBD plasma levels were 181 ng/mL, 376 ± 78 ng/mL (mean ± SEM) and 340 ± 4 ng/mL for the 12.5, 20 and 25 mg/kg/day group, respectively. Fourteen days after discontinuation of CBD treatment the CBD values were 13, 24 ± 5 and 3 9± 14 ng/mL for the 12.5, 20 and 25 mg/kg/day treatment groups, respectively.

Conclusion: CBD, in the form of Epidiolex®, may be efficacious in PD, but the dose used in pediatric epilepsy patients was associated with liver enzyme changes that may be cholestatic and resolved in this older PD population. Further study at lower doses with monitoring of liver function in PD is indicated.

6B: A Prospective Natural History Study of Cannabinoid Use among Patients with Epilepsy
Heather Jackson, Realm of Caring Foundation

Introduction: Epilepsy is a class of serious neurologic disorders that is difficult to treat. Many epilepsy patients use cannabis, cannabinoid extracts, or other cannabinoids for symptom relief based on anecdotal accounts, and, more recently, clinical trials of cannabidiol (CBD). Little systematic data has been collected about the naturalistic use of cannabinoids for epilepsy.

Methods: Patients or adult caregivers registered with the Realm of Caring Foundation, a non-profit focused on education related to the use of hemp products for epilepsy and other health conditions, were invited to participate in a web-based survey study that assessed demographic and health-related outcomes. Participants completed a baseline assessment and were then asked to complete follow-up surveys every 3 months. Analyses compared patients using cannabinoids versus those who were not at baseline, and to evaluate changes from baseline among patients who were not using cannabinoids at baseline, but initiated use during the follow-up assessments. T-tests and Chi-Square tests were used and significance was determined at p<0.05.

Results: At baseline, 168 patients were using cannabinoids and 105 were contemplating initiating use, but had not yet done so. Products high in CBD, versus those high in THC, were predominant among those who had initiated cannabinoid use, and use was typically either an adjunct to traditional treatments or used as a last resort when other treatments failed. On average, cannabinoid users were significantly older than non-users, but did not differ on gender, race/ethnicity, or educational attainment variables. Cannabinoid users reported significantly better health satisfaction and sleep quality, and lower anxiety and depression compared with non-users on validated assessments. Non-users were more likely to report past month outpatient hospital, inpatient hospital, or emergency room visits, and were more likely to have had a sick day from work/school in the past month compared with cannabinoid users. There were no differences between groups on self-reported quality of life or number of prescription or OTC medications used.

Of the 105 patients not using cannabinoids at baseline, 35 initiated use prior to completing a follow-up assessment. Compared with

baseline, the individuals who initiated cannabinoid use had improved self-reported health satisfaction, reduced the number of prescription medications taken, and reduced depression after initiating cannabinoid use. Children in this cohort also had improved sleep following initiation of cannabis or cannabinoid products. One patient stopped use of cannabinoids due to an increase in seizure activity observed after initiating use.

Conclusions: In a convenience sample of epilepsy patients enrolled in an observational research registry, current users of cannabinoids reported better outcomes across a number of health-related measures compared with a demographically similar group of epilepsy patients not using cannabinoids. Among non-users at baseline, initiation of use was associated with improvements in health and a reduction in prescription medications used. This prospective natural history study indicates an overall clinical benefit of cannabinoid use among epilepsy patients using products high in cannabidiol, indicating the need for additional drug development and controlled clinical research in this area.

6C: Cannabis Legalization in Colorado and the Impact on Travel and Tourism
Charles Cattermole, Grand Canyon University

The purpose of this study is to identify how the legalization and taxation of cannabis has impacted travel and tourism revenue in the state of Colorado. The results of this study may impact the future implications for other states seeking to legalize and tax cannabis; considering that more research needs to be conducted about the indirect economic impacts related cannabis legalization.

6C: Medical Marijuana Is Dead, Long Live Medical Marijuana: A Public Policy Analysis of Cannabis Markets in Transition
Jason Kikel, Cannabiz Media, and *Joe Sciabica*

In the two decades since the nation's first state medical cannabis program was approved by California voters, the cannabis economy has expanded and changed greatly. Over half the states permit medical cannabis programs to some degree, while nearly one-fifth of states now permit adult use (nonmedical) cannabis sale and consumption, as an expansion of existing medical sales, or as a separate market alongside the existing medical cannabis regulatory infrastructure. This paper compares transitions from medical to adult use cannabis economies in eight states that had successful ballot initiatives in the election years between 2012 and 2016 (Alaska, California, Colorado, Maine, Massachusetts, Nevada, Oregon, Washington) to dissect market trends. To better understand the evolution of the cannabis economy, this paper will evaluate metrics including legalization mechanism, market structure, and initial sales period. Additionally, legalization's impacts on state agencies, municipal governments, business owners, and patients is will be assessed. Finally, this paper will provide a road map for states considering taking the next step: expanding a medical cannabis market into an adult use one.

6C: Political Risk and Investment in the Cannabis Industry
Jared Bressler, Colorado State University-Pueblo

Cannabis as an industry faces political risks from multiple levels of government. Voters and/or governments at state and local levels can ban cannabis (as Pueblo voters considered doing in 2016). The federal government also possess a significant political risk since cannabis remains a class one controlled substance meaning that the entire industry exists at the tolerance of the executive branch and the justice department. Even the increased political popularity of cannabis possess risks. When new states legalize recreational cannabis it competes with Colorado as a destination for tourists seeking a legal high. Furthermore, the federal ban means that state cannabis industry exists in near autarky since cannabis products cannot be traded legally across state lines. If cannabis becomes legal on the national level current business will see a rush of competition creating volatility. This paper will look at investment in the cannabis industry by looking at permits to open new cannabis business to understand what the effect of political events have on investment.

6E: *The New Cannabis Paradigm*: A New Book About All Things Cannabis
Timothy McGettigan, Colorado State University-Pueblo

A new era in cannabis inquiry has dawned. In recent decades attitudes toward cannabis have shifted dramatically. No longer does Harry Anslinger's reefer madness universally predispose Americans to fear and loathe the devil's weed. Unprejudiced scientific studies have revealed that cannabinoids have myriad medical benefits and, astoundingly, the human body is regulated by an endogenous cannabinoid system.

People all over the world are undergoing an historic paradigm shift. Where once Anslinger clones browbeat the public into believing that cannabis was the root of all evil, critical thinkers are waking to the realization that cannabis is a relatively benign and medically beneficial plant.

6F: An Analytical Look at Hemp Genetics Using Traditional and Modern Methods
Elliot Brown, AHT Limited

The burgeoning industrial hemp industry contains both amazing opportunities and treacherous pitfalls, primarily due the lack of availability of quality genetics on the market. Hemp farmers whose crops accumulate too much THC must discard their crops at considerable financial loss and have little guidance in making appropriate decisions regarding genetic acquisition.

Our objectives include: finding unique and desirable phenotypes to begin production of inbred lines for downstream breeding/molecular genetics work, to make accurate decisions during selection through chemical analysis, and facilitate availability of sound genetics to farmers through seed, traditional cuttings, and plant tissue culture. Our research focuses on analysis and selection of desirable phenotypes from field stock using primarily non commercially available varieties.

19,500 seeds of over 40 industrial hemp varieties were cultivated in western Colorado during the 2017 season. Several hundred of the most desirable phenotypes were initially selected based on a variety of visual criteria and anticipated post season chemical analysis including: overall plant morphology, flower set, flower fragrance, and analysis of CBD/THC/CBG or other cannabinoids using gas chromatography. Highly desirable female phenotypes had flower samples taken at 2 to 3 time points throughout the flower cycle to create a curve for CBD/THC accumulation over time. This allows us to move forward with appropriate phenotype selection/rejection and bulking. Over 400 seed crosses were made with the ability to analyze female flower for selection purposes. 1,200 cuttings representing 200 plants were also taken

at the end of the growth cycle from the most desirable phenotypes to facilitate clonal propagation for field stock for the 2018 season. These plants were reverted back to vegetative growth and will be either eliminated or propagated for next season based on the cannabinoid accumulation curve.

Findings and conclusions are to be determined as we are currently sourcing funding to purchase a gas chromatograph. We should have the equipment in our lab by Jan 1 2018 and be able to fully provide results from our approximately 1,500 samples to generate our data set. We anticipate a reasonable number of cuttings and seeds crosses that will qualify after the cannabinoid potency testing and a certain amount that will not. Some of the ones that make the cut will not make the cut for other reasons such as height, weight, or improper morphology. These data will be compiled and presented by the time of the conference.

7A: Cannabis Patient Registry
Sue Sisley, Scottsdale Research Institute

CSU-Pueblo is developing an international, medical cannabis patient registry. Development and maintenance of the registry was awarded to ValidCare, a Colorado-based digital health and analytics company serving the cannabis market. At this session, co-principal investigators Sue Sisley, MD, professor Jane Fraser, PhD and Patrick McCarthy, CEO of ValidCare will share their progress and vision for the registry and its uses by the diverse cannabis community. Ultimately, patients, medical professionals, growers and processors will be able to provide and use data to understand outcomes and effects of cannabis.

7B: Cannabis: The Exit Drug
Uma Dhanabalan, Global Health & Hygiene Solutions, LLC - Uplifting Health & Wellness

Cannabis is a plant that has been used for thousands of years throughout the world. It has multiple purposes from medicine to industrial products. Cannabis is in Schedule 1 along with heroin, LSD, and ecstasy since 1970 in the United States of America. Cannabis works with our body's endocannabinoid system for homeostasis and most people and healthcare providers are not aware or taught about it. The positive impact of cannabis on human health and mankind has been limited due to prohibition, politics and stigma.

This presentation by Dr. Uma, a cannabis therapeutics specialist, who is a Diplomate of the American Academy of Cannabinoid Medicine, trained in Family Medicine, from Medical University of South Carolina and Occupational and Environmental Medicine, from Harvard. Dr Uma draws from over 30+ years of experience in both research and patient care to Dr. Uma's TotalHealthCareTHC. She will cover the history of cannabis, the endocannabinoid system, delivery methods and its applications. Dr. Uma educates, embraces, and empowers her patients and the use of cannabis as a supplement to improve quality of life while decreasing and eliminating prescription medications.

It is time to move beyond the stigma, misconceptions and misinformation associated with this healing plant. It is time to "open your hearts and open your minds," improve quality of life and learn more about the healing properties of cannabinoids. We are facing an opioid epidemic: the United States of America is about 5% of the world's population, yet they consume about 80% of the world's pain medication. One American dies from a prescription drug overdose every 19 minutes, deaths from medication abuse outnumber motor vehicle accident deaths. Dr. Uma states "cannabis is not for everyone, yet is should be a first line option not the last resort," and "cannabis is not an entrance drug, it is an exit from pharmaceuticals, narcotics and alcohol."

7B: A Metabolic Perspective on the Evolution of Species and Cancer
Robert Melamede, Phoenix Tears Foundation

What if the standard mutation-based view of the evolution of species and cancers is incomplete to the extent that we have created an all-encompassing framework that misses the fundamental creative nature of nature? What if the scientific reality of ongoing creation has been replaced with a stagnant dogma of accident driven evolution?

If we reverse our current perspective, previously miraculous, improbable events may be readily understood from first principles that emerge by embracing a far from equilibrium thermodynamic perspective. Most pertinent to understanding the physics of life is to understand that flowing energy organizes matter. Conceptually, life is a dynamic flow dependent adaptive fractal that itself creates new selection parameters with each reiteration. Energetically, living systems must be consistent with the second law of thermodynamics as extended to open flow dependent systems. The entropy exported to a cell's surrounding, must be sufficient to maintain its flow dependent internal organization.

Life's main energy sources, carbohydrates and lipids, are not functionally equivalent. Carbohydrates preferentially feed the efficient, but dangerous, electron transport system that promotes and supports differentiated cellular functions (nerve transmission, muscle contraction, hormone production, etc). In contrast, enhanced antioxidant activity, coupled with cellular recycling (beta oxidation, autophagy) allows a state of health to emerge from a living system (mathematically speaking an attractor).

In all vertebrates there is a balance between CB1/electron transport driven ATP production and production from recycling free radical damaged cellular components driven by CB2 activity. CB2, via fat-burning promotes symmetrical stem cell expansion, whereas CB1 activity promotes stem cell differentiation.

The underlying concept is that survival of the fittest means survival of the most adaptable. Consequently, the initial selection for a systemic state occurs at the metabolic, not the genetic level. Metabolic imbalances promote excess free radical production that focuses change on the genes and their controlling regions that are responsible for survival. Hence, evolution for the most part occurs by metabolically focusing evolutionary change in a multi-gene fashion that promotes the systemic survival state.

A logical consequence of this thinking is that chemotherapy and radiation select for survivable metabolic states that in turn promote the accumulation of genetic changes that become the record of the successful metabolic state. A simple example of the suggested phenomena is the selection for the metabolic state known as the Warburg effect (aerobic glycolysis) by cancer cells.

Eukaryotic cells turn off the electron transport system during the S phase of the cell cycle to protect replicating DNA from metabolically generated free radical damage that could intimate apoptosis. Therefore, natural selection selects the metabolic states associated with survival. However, the survivals states retain their metabolic imbalance

that initiated the uncooperative homeostatic biochemical dynamics in the first place, that in turn becomes genetic through pseudo-targeted mutagenesis.

Energy, driving creative evolutionary change, provides an easy to understand explanation for the evolution of life, species and similarly, drug resistance and tumor genetic diversity. Clearly new concepts that potentially offer important beneficial health consequences need to at least be considered. The existing scientific and medical framework has been unsuccessful in creating the desired health outcomes because healthcare must be founded on a sound health-driven scientific foundation that builds on successful health outcomes rather than successful financial endpoints.

7B: Better than Cannabis? Can Big Pharma and Medical Marijuana Co-Exist?
Martin A. Lee, Director, Project CBD

This presentation will examine various ways that scientists are targeting the endocannabinoid system with synthetic drugs and isolates. Initial efforts focused on cannabinoid receptor activation or antagonism. Because direct, full-on stimulation of CB1 receptors in the brain may trigger undesirable, psychoactivity, cannabinoid researchers are pursuing several strategies to deliver therapeutic benefits without conferring a marijuana-like high. These strategies include peripherally restricted CB1 agonists that don't cross the blood-brain barrier; selective CB2 agonists that only activate cannabinoid receptors outside the central nervous system; and allosteric modulators that can increase or decrease the efficacy of CB1 & CB2 receptor activation by endocannabinoids and plant cannabinoids. Researchers are also experimenting with synthetic compounds designed to modulate "endocannabinoid tone" without binding directly to cannabinoid receptors. Synthetic inhibitors of endocannabinoid-metabolizing enzymes (FAAH, MAGL) increase the levels of one or more endogenously released endocannabinoids at CB receptors. By targeting endocannabinoid transport molecules (fatty acid binding proteins), synthetic endocannabinoid reuptake inhibitors increase endocannabinoid levels in a manner that enhances endocannabinoid-induced protective effects. THC and CBD also function as endocannabinoid reuptake inhibitors, thereby boosting endogenous cannabinoid signaling. A comparison of the pros and cons of pharmaceutical isolates and artisanal cannabis suggests that vilifying either holistic herbal medicine or modern single-molecule medicine is not helpful. Both approaches can be valuable. Preclinical research indicates that plant cannabinoids synergize favorably with conventional chemotherapies and radiation treatment. Patients are best served by having access to a wide range of cannabinoid-based therapeutic options. Regulatory policy should not privilege single-molecule cannabinoids over whole plant cannabis remedies.

7C: Job Quality in Colorado's Cannabis Industry
Brad Gilbreath, Colorado State University-Pueblo, *Patrick Radigan*, Colorado State University-Pueblo, and *Sara Yacovetta*, Three Rivers Dispensary

This presentation reports on a study of job quality in Colorado's hemp- and marijuana-related businesses. The intent of the study is to assess whether the legal cannabis industry is creating good jobs. The study, which compares survey data from respondents working inside the legal cannabis industry to a control group of respondents who do not work in the industry, is in the data collection phase. Research challenges and preliminary findings will be discussed.

7C: Occupational Safety Training for Marijuana Cultivation Workers
Joshua Scott, Center for Health, Work and Environment at the Colorado School of Public Health

Marijuana cultivation is a significant emerging industry with many job hazards. As in most emerging industries, occupational accident and injury surveillance is lagging behind worker needs. Although some safety guidance exists for indoor grow facilities, it is not well disseminated. In 2017, the Center for Health, Work and Environment at the Colorado School of Public Health produced two in-person and one webcast full-day safety training events attended by over 250 workers. In this educational session we will share the training framework and curriculum, discuss safety partnerships and capacity building with contentious and emerging industries, and discuss training results, and behavior change among cultivation workers.

7F: Pharmacy to Philosophy to Poetry: What Is Your Bliss Beyond Cannabis?
Dean Frankmore, Colorado Center for Cinematic Studies

A survey and conversation involving audience participation, this panel discussion progresses through a series of cannabis questions big and small, beginning with: What is your bliss beyond cannabis, and why is this question so important for the cannabis consumer to answer and explore?

Presenting myself a case study where I share my 25-plus year history as a cannabis-consuming pharmacist, writer, philosopher, and explorer of mind, our aim in this panel discussion is to take a good look at this singular phenomenological investigation of "cannabis consciousness," as well as take a good look at ourselves, individually and collectively, as cannabis consumers and otherwise.

For example, suppose you're a cannabis consumer who is selected to participate in a study on the long and short-term effects of cannabis on the human mind? What would you consider a fair measurement? Do you think an IQ test will be enough? What would you share about your cannabis experience in such a test? What are the benefits and risks of cannabis, its positive effects and (potential) downfalls? How might this study measure you as a whole person, mind, body, and spirit? So far as applied pharmacy, we might ask: How does cannabis compare with anti-depressants like Prozac, and might the herb be employed as an effective mood-modulating agent?

Philosophically we'll discuss the idea of cannabis epistemology and its implications concerning scientific research, reporting, and ethics. Namely, if cannabis helps you with your work—i.e., stimulating creativity and thought or otherwise advancing what you know and how you come know it—should this herbal assist be reported or somehow admitted in the name of academic honesty and scientific integrity? Are such matters too taboo, or simply too private, to discuss? How do laws stifle inquiry, and what is the effect of dishonesty and misinformation in system integrity? Does governmental grant money bias cannabis research? What is the science of altered states of consciousness and how is it practiced? What about the realm of cannabis psychotherapeutics; to what extent has this territory been explored and what models, if any, are followed in its practice?

More speculatively we might further expand the frontier of can-

nabis inquiry and explore some rarely if ever discussed hopeful PO-Tentialities. Might cannabis enhance neuroplasticity, and even serve to advance evolution of the human condition? What does the historical evidence have to say about this? Is there a connection between dual-brain psychology and the effects of cannabis on human consciousness? Does cannabis turn-on the right-brain or otherwise alter the "normal" flow of information through the corpus callosum? How might cannabis serve a gateway to interdisciplinary study and promote academic community? These are just some of the questions we may, or may not, explore.

That's a lot, and it's only scratching the surface. Are such conversations reserved for a bold few? Perhaps. Perhaps not. Since audience participation is encouraged right from the beginning, our conversation should be fun, revealing, and hopefully helpful to all.

8A: Translating Science into Products That Perform
Raj Gupta, Folium Biosciences

Forty years of safety and efficacy data on cannabidiol are compiled into a succinct summary. The observational and clinical studies are assessed for their definitive and directional conclusions. Approaches for translating a plethora of scientific evidence into designing consumer and pharmaceutical products are discussed. In addition, consumer insights are added for continuous improvement during the life-cycle of the product.

8B: Analysis of the Metabolic Pathways Affected During Cannabinoid Receptor Activation and Its Impact on Viral Replication Using a Seahorse XF Analyzer
J. Jordan Steel, Colorado State University-Pueblo

Cannabinoid receptors are found on cells all throughout the body. Endogenous and/or exogenous cannabinoids can bind to the receptors and trigger a specific cellular response. Various synthetic receptor agonists and antagonists are available to directly activate or inhibit the CB1 and CB2 receptors. It has been shown that activation of the CB1 receptor in liver cells increases metabolic pathways including fatty acid synthesis and gluconeogenesis. Current published literature has shown basic trends of metabolic changes during cannabinoid receptor activation, but a detailed analysis of which cellular pathways are involved and real-time data showing the changes was lacking. We have recently acquired a Seahorse Metabolic Bioanalyzer from Agilent that allows us to investigate and track metabolic changes in cells during activation of both CB1 and CB2 receptors. We are able to add a specific cannabinoid receptor agonist to human liver cells and then use the Seahorse bioanalyzer to monitor changes to the cellular metabolism. The Seahorse Bioanalyzer allows us to measure specific metabolic pathways in real-time with living cells and quantifies the amount of oxygen used, protons released, and other biological metabolite indicators. These results are helping enlighten exactly how endo/exo cannabinoids directly alter metabolism on a cellular and molecular level. We have preliminary data showing that mitochondrial metabolism is altered during cannabinoid stimulation in liver cells. We are also investigating how viral infections modify the host cell metabolism. Our data indicates that stimulation of the CB1 receptor alters cellular metabolism and directly effects the viral replication. This has big implications for public health as there are millions of people infected with liver viruses and the impact of cannabis use on those viral infections has yet to be described.

8B: Compound-Specific Carbon Isotope Measurements of Lipids Verify Cultivation Conditions of Cannabis of Unknown Origin
Brett J. Tipple, University of Utah

Stable carbon isotopes are naturally occurring chemical "barcodes" that record a plant's cultivation conditions. Measurement of the carbon isotopes of cannabis floral material has been an established method used by the law enforcement community to characterize production methods of illicit cannabis. This quantitative tool is primed to become a powerful technique to determine the production origin of cannabis in the emerging medical marijuana and adult-use marketplaces. Given the rapid market growth of cannabis extracts and products that derive from these extracts, the question becomes how does one guarantee that illicit material has not entered into the production line when only cannabis extracts are available? Thus, additional compound specific isotopic tools are now required to assess the cultivation conditions of many cannabis products. To understand if production method is translated to the isotope chemistry of specific cannabis compounds, we measured the carbon isotope ratios of *n*-alkanes (i.e., a ubiquitous class of lipids found in all *Cannabis* species specimens) isolated from inflorescences of specimens seized by federal agents. We found the carbon isotope ratios of *n*-C29 from *Cannabis* grown in enclosed environments had lower carbon isotope ($\delta^{13}C$) values compared to plants from open-field environments. It is well established that the $\delta^{13}C$ value of source CO_2 regulates the $\delta^{13}C$ values of plant materials. We posit the combination of naturally respired CO_2 as well as artificially elevated CO_2 levels within the enclosed systems led to lower $\delta^{13}C$ values of *n*-alkanes from *Cannabis* cultivated in enclosed environments. These findings coupled with plant physiological models can be used to determine a likelihood ratio that an unknown *Cannabis* species was cultivated in an enclosed or an open-field environment. As stable carbon isotope signals are independent of product label claims and permanently retained within cannabis compounds, we suggest that growers, processors, regulators, and/or law enforcement officials may be used these lipid markers to trace the cultivation method of cannabis.

8C: A Study on THC Thermal Degradation
Mark Angerhofer, PhytaTech

Cannabis concentrate processing consists of concentrating THC from plant material while removing inactive compounds or other plant products present in cannabis. This is often done using carbon dioxide or butane to achieve mid-level purity of cannabinoids. To achieve higher purity products, different processing techniques need to be utilized. This concentrate processing may involve using thermal separation techniques such as short-path or wiped-film distillation. Cannabis concentrate distillate production performed at high temperatures may form THC degradation products leading to lower THC yields and formation of unknown THC degradation by-products. This phenomena has been observed numerous time in Colorado and has led to confusion as to what exactly is going on during these processes. This study aims to characterize these THC degradation by-products through refluxing a typical cannabis distillate at 250 ± 10 °C, 1 atm.

8C: A Survey of Cannabis Plant Material in Colorado for the Presence of Mycotoxins
Kris Chupka, Next Frontier Biosciences

Recently the Colorado Department of Health and Environment (CDPHE) has proposed adding mycotoxins as required testing for certain cannabis products. The proposed analytes to be monitored are Aflatoxins B1, B2, G1, and G2 and Ochratoxin A. These proposed regulations are closely aligned with other states that have legalized cannabis. However, there is little available evidence that cannabis harbors mycotoxins. We will investigate mycotoxin levels in plant material that showed evidence of microbiological contamination (yeast and molds), obtained from a state certified testing laboratory, for residual levels of a broad spectrum of mycotoxins using the Sciex Triple TOF 5600 LC/MS/MS. This screening will be performed using a combination of reference materials and electronic database searches. The specific compounds evaluated include those proposed for monitoring by CDPHE and the following: 3-acetyl DON, 15-acetyl DON, F-X, DON, Nivalenol, Neosolaniol, Diacetoxyscirpenol, HT-2 Toxin and T2 Toxin. The results will provide a comprehensive overview of the potential for mycotoxin contamination in commercial Colorado cannabis.

8C: Development of a Novel, Efficient Method for the Extraction of Cannabidiol (CBD) from Bulk Industrial Hemp
Dustin Seifried, Colorado State University-Pueblo

This project focuses on the development of an efficient extraction method for the recovery of the cannabinoid, cannabidiol (CBD) from industrial hemp. Industrial hemp has been classified as having no more than 0.3% Δ-tetrahydrocannabinol (THC) by Senate Bill 241. The extraction method is based on the use of pressurized liquid extraction (PLE). The extraction temperature, the number of static extraction cycles, and static cycle length were optimized in order to maximize the recovery of CBD. The PLE method included a pre-extraction with water followed by an extraction with ethanol. The water pre-extraction was solely used to physically disrupt the sample and promote decarboxylation of acidic cannabinoids without significant loss of neutral cannabinoids resulting in better recovery of CBD compared to extraction with ethanol alone. Maximum CBD recovery occurred when the water pre-extraction occurred at 140°C and the ethanol extraction at 100°C. As the extraction temperature of the pre-extraction with water is increased the recovered quantity of the acid forms, cannabidiolic acid (CBD-A) and tetrahydrocannabinolic acid (THC-A), decreases while the quantity of the neutral forms, CBD and THC, correspondingly increase as a result of decarboxylation. When two three-minute static water pre-extraction cycles were included and along with the four three-minute static extraction cycles with ethanol this resulted in significantly greater CBD recovery. Although the number of static cycles proved more important than overall extraction time, time for the pre-extraction with water is important due to time required for decarboxylation of CBD-A to CBD. Once the optimized extraction parameters were determined, industrial hemp samples were extracted using the developed method and compared with an established extraction method for cannabinoid quantification from the United Nations Office on Drugs and Crime (UNODC). There was nearly a 20 fold difference in the CBD recovery and an 11 fold difference in THC recovery from these two methods. The UNODC extraction yielded 444 ug/g CBD and 569 ug/g THC whereas the pressurized liquid extraction yielded 8672 ug/g CBD, and 6455 ug/g THC from the same hemp sample. As a result of efficient decarboxylation during extraction there was little to no CBD-A or THC-A in the PLE prepared samples, but the UNODC method yielded 6335 ug/g CBD-A and 5984 ug/g of THC-A. A One-Way variance analysis, (ANOVA) and Tukey HSD (Honest Significant Difference) was completed to identify the effects of extraction parameters on the recovery of CBD by PLE.

8E: A New Taxonomy for the Plant of Many Names
Louis Adam, Cantelligence

With the exception of *Homo sapiens*, few organisms other than the cannabis plant have such a contested taxonomy. The many cultivators are often separated into distinct groups with their own criteria set by the researchers, patients, and professionals who use them for medicinal, adult-leisure, or hemp(seed) harvest purposes. Each has been created with the intention of consolidating the many cultivators into manageable logical groups. Although these isolated systems of classification streamline communication in their field, the methods of classification are incompatible with one another and breed confusion. The differences in classification come from alternative views of the plant's geological history and number of distinct species. The disagreement over the identity of cannabis has more less-evident effects than the obvious disorganization. The absence of a universal system has impeded the translation of scientific findings. For example, for years cannabis research professionals used the term *Cannabis indica* to refer to all variants of the plant use for medicine and *Cannabis sativa* to refer all other variants. At the same time those in the medical cannabis community divided plants used for medicine into *Cannabis sativa* type narrow-leafed plants and Cannabis indica type broad-leafed plants. This subtle difference can drastically change the interpretation of research results and communication of such findings among members of different fields in the cannabis community. Furthermore the desire to separate the cannabis plant into many species enforces an idea of strict genetic separation between the proposed groups, inadvertently halting the potential of cannabinoid research. Many cannabis populations native to various parts world have been destroyed as a result of drug prohibition. The variants that have been preserved were grown for their ability to produce hemp fiber or psychoactive cannabinoids. Thus the flow of genes between cannabis populations has been tightly restricted for decades which leaves us with a smaller range of cultivator phenotypes. As recently as 2015, researchers from the University of Mississippi discovered 7 new cannabinoids. If cannabis strains were allowed to breed more freely, it would be possible to discover even more cannabinoid and/or terpene compounds. Consolidating, reforming, and standardizing our taxonomical standards of cannabis can serve as a solution to the aforementioned issues. A system that arranges the multitude current variants of cannabis can allow for better cooperation between researchers, industry professionals, medical patients and adult-leisure consumers. Such a change could mitigate the ambiguity of research findings, promote creative breeding practices (resulting in a wider range of plant phenotypes), and demystify the plant aiding its reputation as an effective medicine. As a cannabis YouTube educator, writer, and pharmacy doctoral student, I hope to bring a fresh perspective on the issue of cannabis taxonomy. To properly summarize the issues of cannabis classification I will give an overview of the plant's genetic and geological history and current taxonomic views before discussing the problems with our current system and describing an alternative naming system as suggested in Ernest Small's *Evolution and*

Classification of Cannabis sativa in Relation to Human Utilization.

8F: #Cannabisjournalism: Reporting on America's New Normal
Andrew Matranga, University of Denver

The conversation surrounding cannabis in American culture is evolving every day, and the reporting is changing with the times. Cannabis as a story has never been a laughing matter for me. As an Assistant Teaching Professor at the University of Denver, I created the first Cannabis Journalism course in the country. The course aims to empower young journalists with the skills they need to report on "America's New Normal." I know cannabis seems fun and exotic. I know it elicits half-baked puns and decades-old stereotypes, but I believe cannabis is a serious topic. It has far-reaching implications, from federal drug policy, medical research, and international trade to local taxes and even vending machine ordinances. With other states looking to Colorado as an example, of what to do and what not to do, accurate and responsible reporting on cannabis is more critical than ever.

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